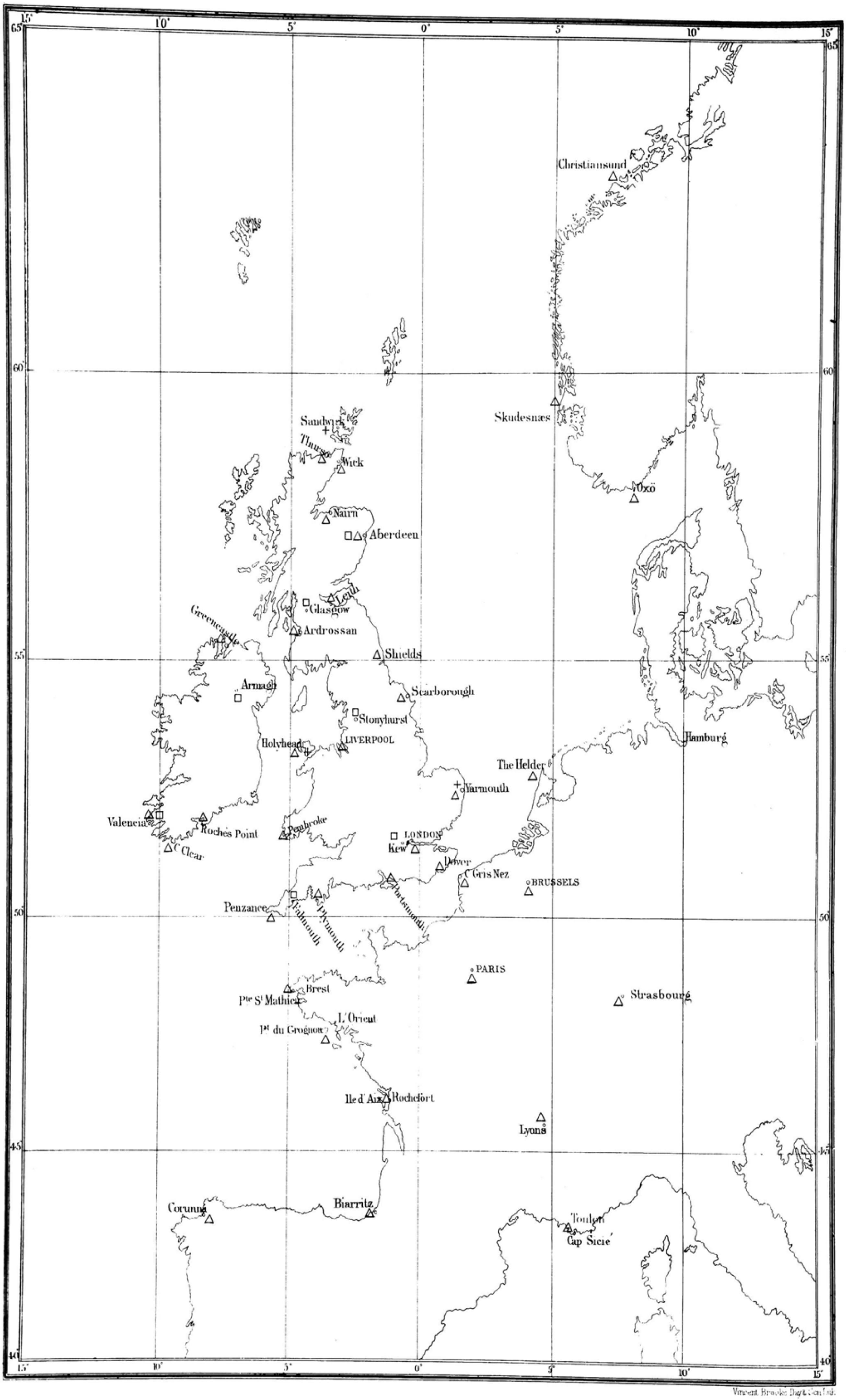
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Stonyhurst
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LIVERPOOL
Hamburg
The Helder
Yarmouth
Valencia
Roches Point
C Clear
Pembroke
LONDON
Kew
Dover
C Gris Nez
BRUSSELS
Penzance
Falmouth
Plymouth
Portsmouth
PARIS
Brest
Pte St Mathieu
Strasbourg
L'Orient
Pt du Croisic
Ile d'Aix
Rochefort
Lyons
Corunna
Biarritz
Toulon
Cap Sicié

Vincent Brooks Day & Son Lith.

Chart shewing the Telegraphic Reporting Stations △ Self-recording Observatories ☐ and Anemometers +
in connection with the Meteorological Office.
April 1870

Official, No. 7.

C
1252

QUARTERLY WEATHER REPORT

OF THE

METEOROLOGICAL OFFICE

For 1869.

Published by the Authority of the Meteorological Committee.

12

[11423.—500.
P. 3051.—125.} 3/71.]

PREFACE.

Part I. of this Report appeared in August 1870, and Part II. at the beginning of December. Since that date the rate of production has been increased, and the last two parts have appeared in quicker succession.

In Parts I. to III. the Plates have been transferred to stone by an ordinary pantagraph, from zinc templates obtained from Mr. Galton's pantagraph. In Part IV. the curves have been traced from the zinc on copper by Wagner's pantagraph, and dry impressions from these plates have been transferred to stone.

The lithographic printing has all been by the dry process to avoid the risk of error from shrinkage of paper.

Considerable difficulty was at first encountered from the fact that the base lines of the photographic curves were not absolutely straight. This involved the necessity of remeasuring every curve at frequent intervals, comparing the results with the original hourly tabulations furnished from the respective observatories, and correcting any errors which might be discovered.

Measures have been adopted to remove one part of this source of error in future, and an instrument has been designed by which the original traces will be mechanically corrected, whenever the distortion of the base line proves that they require correction. It is hoped that in a short time the curves will be printed directly from the copper. The degree of accuracy attained is to 0·02 in. for the barometer, and $0^{\circ}\cdot5$ F. for the thermometer.

March 1871.

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ERRATA.

Introduction, page viii, line 23, *for* 0·02 in. is *read* 0·2 in. is nearly.
„ „ „ „ 24, *for* the gradients *read* the figures representing the gradients.
„ „ „ „ 27, *for* five *read* half.
„ „ ix „ 3, *for* 5 *read* 0·5
„ „ „ „ 4, *for* 44·8 *read* 44·7
„ „ „ „ 5, *for* $\frac{44\cdot8}{13} \times \frac{2}{5} = 13\cdot5$ *read* as 0·01 in. = ·254 millimètres $\frac{44\cdot7}{13} \times \frac{1}{\cdot254} = 13\cdot5$ half millimètres per 100 geographical miles.

Page 37, Armagh minimum barometrical reading for April, *for* $\overset{D}{28}$ *read* $\overset{D}{15}$
„ 39, Stonyhurst maximum temperature for November, *for* $\overset{D}{15}\cdot\overset{H}{17}$ *read* $\overset{D}{15}\cdot\overset{H}{5}$
„ 40, Kew maximum temperature for July, *for* $\overset{D}{22}\cdot\overset{H}{14}$ *read* $\overset{D}{22}\cdot\overset{H}{2}$
„ 43, Explanation of Table—
line 11, *for* 5 *read* 0·5
„ 12, *for* 44·8 millimètres and $\frac{44\cdot8}{13} \times \frac{2}{5} = 13\cdot5$ *read* 44·7 millimètres and as 0·01 in. = ·254 millimètres $\frac{44\cdot7}{13} \times \frac{1}{\cdot254} = 13\cdot5$ half millimètres per 100 geographical miles.

Page 45, line 6 from bottom, *for* 5 p.m. *read* 5 a.m.
„ 47, „ 7 „ *for* England *read* Ireland.
„ 57, „ 3 „ *for* 1·001 *read* 1·003
„ 59, „ 7 from top, *for* 33·9 „ 36·9
„ „ „ 8 „ *for* 25·8 „ 26·2
„ „ „ 4 from bottom, *for* 27·3 „ 27·0
„ „ „ 2 „ *for* 32·5 „ 31·5

EXPLANATION OF TECHNICAL TERMS USED.

"Gradient."—The amount of difference in barometrical readings over a given distance, calculated in hundredths of an inch of mercury per fifty geographical miles.

"Anemogram"
"Barogram"
"Thermogram" } The continuous record, for wind, pressure, or temperature respectively, furnished by a self-registering instrument.

"Isobaric Lines"
"Isobars" } Lines joining the stations where the pressure is equal on any day.

"Veering and backing of wind."—The wind "veers" when it shifts *with the sun* from E. through S. to W. or through any azimuth in that direction. It "backs" when it shifts *against the sun* from W. through S. to E. or through any azimuth in that direction.

"Cyclonic."—The wind is said to have cyclonic motion when it sweeps through any arc round an area of relatively low barometrical pressure. In this case the horizontal motion of the air is always against the sun.

"Anti-cyclonic."—The wind is said to have anti-cyclonic motion when it sweeps through any arc round an area of relatively high barometrical pressure. In this case the horizontal motion of the air is always with the sun.

METEOROLOGICAL OFFICE

INTRODUCTION.

THE seven observatories established by the Meteorological Committee were all set in action before September 1, 1868, Kew, Stonyhurst, and Glasgow having been in operation on the 1st of January. The first records received from Aberdeen were those for April; from Armagh and Falmouth for May; and from Valencia, where the observatory had to be created *de novo*, for August.

Specimen Tables for part of the year 1868 were appended to the annual report of the office for that year.

The Committee propose to commence their systematical publication of results with the year 1869, and the present issue consists of No. 1 of their Quarterly Weather Report, containing the records for January, February, and March. The succeeding quarterly numbers for the year will follow with as little delay as possible. It is intended that the journal shall in future appear regularly at intervals of three months.

In the present number are included the complete tables for pressure and temperature, &c. for the year 1869, and in the Appendix will be found a short discussion of easterly storms by Mr. R. H. Scott.

The plates call for a special explanation. It is evident that the introduction of a system of continuous registration of observations must be followed up by a reproduction of the actual data yielded by the instruments, so that the advantage as regards weather study which has been gained by such a consecutive graphical record shall be presented to the scientific public in its entirety, instead of being in a great measure lost, as it would be, were occasional, even hourly, tabulations the only information published.

The cumbrousness of, and the consequent difficulty in consulting, tables which would give anything like a complete representation of the salient phenomena of our weather, is in itself a sufficient reason for adopting a new form of publication.

The Committee have, therefore, from the first determined to publish simply the instrumental curves without any numerical tabulations. They issued specimens of proposed forms of publication at natural size, in order to elicit opinions as to their utility, and ultimately resolved that the scale of the original records should be reduced so as to bring the entire information for five days from all the observatories within the size of a quarto page. Seventy-three such periods are comprised in the year, and accordingly the complete observations for that period will be contained in 146 plates, of which half are devoted to pressure and temperature, and half to wind.

It was found that no existing instrument was capable of executing the requisite reductions, and accordingly in the course of last autumn Mr. Francis Galton, a member of the Committee, invented a pantagraph, which effects the reduction of the curves in different proportions for the vertical and horizontal scales respectively. The description of this instrument, and the principle of its construction, will be given in the annual report of the office for the year 1869.

The curves now presented are reduced in the ratio of 6 : 1 horizontal, and 2 : 1 vertical measure.

PRESSURE AND TEMPERATURE.—Plate I. and the succeeding plates, numbered with *odd* numbers, contain the consecutive barograms and thermograms. The curves are all measurable by means of the side scales. The reading for any epoch can be obtained by the use of a rule, or of a glass plate with a straight line engraved on it. This line may very advantageously bear the time scale, which, if thought requisite, may be even divided to show hours. The scales are given according to both the British and the metrical systems.

The barograph furnishes its records self-corrected for temperature, and accordingly reduced to their values at 32° F. (0° C.), but not to sea level.

Table A furnishes the data necessary for obtaining this latter correction, together with the geographical position of the observatories, and the height of the thermometer bulbs above the level of the ground at each station. It was unfortunately impossible

TABLE A. - -

BRITISH AND IRISH

Name of Observatory.	Position.		Height of Barometer Cistern above Mean Sea Level.	CORRECTIONS FOR REDUCING								
	Latitude N.	Longitude W.		(Temperature								
				10°			20°			30°		
				Approximate								
				28·0	29·0	30·0	28·0	29·0	30·0	28·0	29·0	30·0
	° ′ ″	° ′ ″	Feet.	+	+	+	+	+	+	+	+	+
VALENCIA - -	51 54 36	10 18 10	23	0·026	0·026	0·027	0·025	0·026	0·027	0·025	0·025	0·026
ARMAGH - -	54 21 13	6 38 52	207	·232	·241	·249	·227	·235	·243	·222	·330	·238
GLASGOW - -	55 52 43	4 17 30	184	·206	·214	·221	·202	·209	·216	·198	·205	·212
ABERDEEN -	57 9 51·3	2 5 59·6	89	·098	·102	·106	·096	·100	·104	·094	·098	·102
FALMOUTH -	50 9 24	5 3 30	211	·236	·244	·253	·231	·239	·247	·226	·234	·242
STONYHURST -	53 50 40	2 28 10·2	361	·402	·417	·431	·398	·408	·422	·386	·400	·414
KEW - -	51 28 6	0 18 47	34	0·038	0·040	0·041	0·037	0·039	0·040	0·037	0·038	0·040

to obtain greater uniformity in the positions of the thermometers, owing to local conditions.

The curves are continuous, and any interruptions which are noticed are for the most part attributable either to defects in photography or to stoppages in the clock arrangements. In the case of the wet bulb thermogram, there is great difficulty in obtaining a continuous record in frosty weather, and accordingly this curve is not unfrequently defective in cold weather, especially during the night hours.

WIND AND RAIN.—Plate II. and the succeeding plates bearing *even* numbers give the entire information as to these elements furnished by the observatories. The principle of registration which has been applied to the anemographs is described in the report of the Committee for 1867. It differs from that originally devised by Dr. Robinson. The anemograph at Armagh has been hitherto one of the old pattern, so that its records could not be reproduced in facsimile in similar form to the others. However, in the course of the present year (1870), Dr. Robinson will receive one of the new pattern instruments, which will furnish results in strict uniformity with those from the other observatories.*

---

* In the Weather Report will be found notices of anemometrical records from an instrument which has been in action since 1862, at Sandwick Manse, Orkney, under the superintendence of the Rev. C. Clouston, LL.D. The construction of this instrument differs slightly from those in use at the observatories. In the month of June it was replaced by another instrument identical with the others erected by the Committee.

TABLE A.

OBSERVATORIES.

BAROMETER READINGS TO SEA LEVEL.															Height of Thermometer Bulb above Ground.	Name of Observatory.
of Air.)																
40°			50°			60°			70°			80°				
Pressure (at Sea Level).																
28·0	29·0	30·0	28·0	29·0	30·0	28·0	29·0	30·0	28·0	29·0	30·0	28·0	29·0	30·0		
+ 0·024	+ 0·025	+ 0·026	+ 0·024	+ 0·024	+ 0·025	+ 0·024	+ 0·024	+ 0·025	+ 0·023	+ 0·023	+ 0·024	+ 0·023	+ 0·023	+ 0·024	Feet. 12	VALENCIA.
·218	·226	·234	·213	·221	·229	·209	·217	·224	·205	·213	·220	·201	·209	·216	4	ARMAGH.
·194	·201	·208	·190	·197	·204	·186	·193	·200	·182	·189	·196	·179	·185	·192	7	GLASGOW.
·092	·096	·100	·091	·095	·098	·089	·093	·096	·088	·091	·094	·086	·089	·092	41	ABERDEEN.
·222	·230	·238	·218	·225	·233	·213	·221	·228	·209	·217	·224	·205	·213	·220	11	FALMOUTH.
·379	·392	·406	·371	·385	·398	·364	·377	·390	·356	·370	·383	·351	·363	·376	7	STONYHURST.
0·036	0·038	0·039	0·035	0·037	0·038	0·034	0·036	0·037	0·034	0·035	0·036	0·033	0·034	·035	10	KEW.

Direction.—The line is intended to give the mean direction of the wind, and the principal oscillations. It would scarcely be possible to exhibit all the minor oscillations when the scale of the record is so much reduced as it is.

Velocity.—The vertical distance represents 50 English miles, and accordingly each diagonal line indicates 50 miles of wind. The *total* velocity during any period, say 24 hours, is at once obtained by multiplying this quantity of 50 miles by the number of such diagonal lines contained within the period. The *mean* velocity per hour may, of course, be easily obtained. The actual velocity at any given hour can scarcely be determined from these plates. It is, of course, ascertained regularly from the original records. In all cases of storms a notice of high velocities will be found in the text of the weather report.

Rain.—Self-recording rain-gauges on Beckley's principle, a notice of which was submitted to the British Association in 1869 by Dr. Stewart, are in process of construction, and will shortly be supplied to all the observatories. The description of this instrument is contained in the annual report of the office for 1869. At present there are no rain-gauges at Aberdeen or Falmouth, and of the others the only one supplied by the Meteorological Committee is at Valencia. The rest are the private property of the respective observatories, and are of various constructions. The instrument at Valencia is a standard gauge of Glaisher's pattern, similar to those supplied to the telegraphic reporting stations.

The amounts entered are those recorded at 10 a.m., and therefore refer principally to the previous day.

WEATHER REPORT.—This has been prepared with the view of supplying a consecutive account of the weather which shall serve as an explanation of the plates. It is a chronicle of the most important meteorological observations made during the period. The sources from which it has been compiled are, in addition to the observatory records, the daily telegraphic weather reports, and the journals of daily observations published by the Observatoire Impérial, Paris, the Royal Meteorological Institute of Norway, and other continental meteorological establishments. These land observations are supplemented by the registers kept by observers at sea in the immediate vicinity of our coasts. Many of the last-named registers are of the very highest value, especially those furnished by gentlemen in the service of some of our great ocean steamship companies.

The report is intended to serve in a great measure as a record of the storms which visit our shores, and it has therefore a special reference to the motion of the wind. The most important fluctuations exhibited by the barograms and thermograms respectively are also briefly noticed, but no attempt is made to give a theoretical explanation of the phenomena, as the report is destined simply to give an account of statistical facts.

In treating of the wind it is, however, impossible to avoid making some theoretical assumptions.

The wind reports at our disposal are made according to two main principles. The observatories record the *velocity* in miles per hour, the telegraphic reports and ships' logs contain entries of the *pressure* on a plane surface.

In fact they supply the information with reference to the well-known Beaufort scale.

0. Calm.		
1. Light Air -	Just sufficient to give steerage way.	
2. Light Breeze -	With which a well-conditioned man-of-war with all sail set would go in smooth water and "clean full" from	1 to 2 knots.
3. Gentle Breeze -		3 to 4 „
4. Moderate Breeze		5 to 6 „
5. Fresh Breeze -	To which she could just carry in chase "full and by"	Royals, &c.
6. Strong Breeze -		Single Reefed Topsails and T.G. Sails.
7. Moderate Gale -		Double Reefed Topsails, Jib, &c.
8. Fresh Gale -		Triple Reefed Topsails, &c.
9. Strong Gale -	- - - - - -	Close Reefed Topsails and Courses.
10. Whole Gale -	With which she could scarcely bear close-reefed Main Topsail and reefed Foresail.	
11. Storm -	Which would reduce her to Storm Staysails.	
12. Hurricane -	Which no canvas could withstand.	

In the third number of "Meteorological Papers," published by the Board of Trade, a comparison is instituted between I. the above scale, II. the so-called land scale (0—6), and III. tables of relation between pressure in lbs. per square foot, and velocity in English miles per hour. The latter tables, given respectively by Sir W. Snow Harris in the pamphlet descriptive of his anemometer, and by Sir H. James in his "Instructions "for taking Meteorological Observations," are reproduced.

Sir H. James' table is calculated on the principle that $P \propto V^2$ in fact that $V^2 \times \cdot 005 = P$.

The "land scale" consists simply of the series of square roots of the first six square numbers, and by combining it with Sir H. James' table we get the following result, which has been very generally adopted:—

Land Scale.	Lbs. per Square Foot.	Miles per Hour.
1	1	14·1
2	4	28·3
3	9	42·4
4	16	56·6
5	25	70·7
6	36	84·8

This table is obviously insufficient, at least in the case of storms, for whereas the highest pressure which is given is 36 lbs., and the corresponding velocity is 85 miles an hour, velocities and pressures respectively exceeding these values have been not unfrequently registered at our own observatories, and also by Mr. Hartnup at the Bidston observatory. The wind in these islands may be safely asserted scarcely if ever to reach the force of 12 Beaufort scale. It can hardly be maintained that storms of the severity of tropical cyclones ever visit our coasts; if they did, the damage done to buildings and vegetation would be far more serious than it is.

However, both Sir H. James and Dr. Lind recognize the existence of pressures far exceeding 36 lbs. per square foot; Sir H. James' table extends to a pressure of 50 lbs., and a corresponding velocity of 100 miles an hour. Dr. Lind's original table, constructed for his anemometer, which is given in the Edinburgh Encyclopædia, allows of a maximum pressure of 62·5 lbs.

It may be interesting to reproduce part of Dr. Lind's table, in order to show how closely the two higher numbers of the land scale correspond with it.

Height of Water Column in Instrument.	Pressure, lbs. per Square Foot.	Height of Water Column in Instrument.	Pressure, lbs. per Square Foot.
1	5·208	7	36·548
2	10·417	8	41·667
3	15·625	9	46·875
4	20·833	10	52·083
5	26·041	11	57·293
6	31·490	12	62·500

The usual plan of converting the figures of the land scale to those of the Beaufort scale, by merely doubling them, is evidently fallacious. The Beaufort scale provides for *all* winds, and estimates them with relation to the sailing powers of a ship; the land scale simply refers to pressures up to 36 lbs. per square foot. There is no correspondence whatever between the two scales, except the chance fact that 6 is one half of 12.

However, even if we take Sir H. James' table for pressure and velocity to be correct, it does not in any way furnish us with the means of comparing the figures of the Beaufort scale with any instrumental record of wind.

In the Wreck Returns published by the Board of Trade, all wrecks or casualties which happen when the force of wind is 9 or upwards are classed together as being due to "stress of weather." It has been the practice of the Meteorological Office to place the commencement of a gale at the next lower number, namely 8. We must therefore assign to this force at least an approximately equivalent velocity, in order to be able to say whether any given gale was or was not felt at an observatory.

This problem is most difficult of solution. The estimates according to the Beaufort scale ought to be made by *seamen at sea,* those published in the daily weather reports are made by *landsmen on shore.*

However it is only just to our observers to say, that they have gained such experience in their work that on the whole their estimates agree very well with each other. The chief points on which they require improvement are, a certain tendency to exaggerate the force, (as shown by the frequency of reports of forces 11 and 12,) and a habit of estimating the force from occasional gusts.

Having satisfied ourselves of the essential truth of a series of Beaufort scale reports, it still remains for us to find an instrumental record of the same wind as that reported by the independent observer.

In order to make a first attempt at establishing some relation of the nature sought, a series of observations according to the Beaufort scale have been made, by permission of Rear-Admiral Schomberg, by the keeper of the old lighthouse, Holyhead, and the results have been compared with the velocities recorded by the anemograph erected last autumn by the Meteorological Committee on the top of the same lighthouse.

The results of the comparison are very interesting as far as they go, but the table is hardly of sufficient authority to be printed in full. We find from it that

The mean of	66	observations gives	36	miles an hour	for force	6
,,	55	,,	43·5		,,	7

These figures are confirmed, at least for easterly winds, by a similar comparison between the records of the anemograph erected by the committee at Great Yarmouth and the log of the St. Nicholas Gat lightship, lying off that town. For the loan of these valuable observations the Committee are indebted to the courtesy of the Trinity House.

It would seem, therefore, that we shall not be far wrong if we assume the velocity of 40 miles an hour at a well-exposed station as about an equivalent of force 7 Beaufort scale, believing that force to be really what is represented by force 8 in the daily weather report.

We are, however, met by a fresh and a most serious difficulty, which is instantly apparent on inspection of the anemogram plates. The velocities registered at the three inland stations, Kew, Stonyhurst, and Armagh, fall very far short of those noticed at the coast observatories.

The period for which cotemporaneous records exist are far too short for us to determine the factor, if any such should exist, by which the velocity at each inland station should be multiplied in order to bring it up to its equivalent at a sea station.

The discrepancy between the two series of records is very striking. As an instance we may quote the 12 hours from midnight to noon on the 26th December 1869. (Appendix, p. 26.) During the whole of this period the hourly velocity recorded at Holyhead was 62·5 miles, while at Stonyhurst it was 17, and at Armagh 12 miles.

Special reference has been made to easterly winds at Yarmouth. The anemograph at that station is erected at the Sailors' Home, on the beach, facing the east. The ground behind it slopes slowly upwards for about a quarter of a mile, and then stretches for many miles to the westward as a perfectly flat plain. The velocity registered in westerly winds is about *one half* of that registered in easterly winds, when the entry at the lightship, at a distance of only two miles at sea, is equal for the two opposite points.

The diminution of the force of wind at inland stations, as compared with observations taken on the coast, was fully recognized by Admiral FitzRoy in the remarks which he appended to the tables already quoted from the Third number of Meteorological Papers.

The method adopted in the present report is to give all velocities of 30 miles and upwards, and to deal with those exceeding 40 miles as gales.

In order to render the remarks as to the relations of pressure, &c., more intelligible, small sketch charts showing the isobaric lines and the strong winds at 8 a.m. are given for any days which appear to present features of interest.

The isobaric lines given are those for the even half-inches, whenever they occur, and in addition the highest and lowest. The arrows represent the winds of force 8 and upwards. All the winds are not given, as it is considered that one arrow would sufficiently indicate a gale prevailing, say at all the stations on the south coast of Ireland. The arrows are not feathered, the scale of the charts being too small to allow of this being done with sufficient distinctness.

In the weather report and other publications of the office constant reference is made to "gradients." The use of this term has been before explained in No. 1 of Non-official Papers.*

The principle is briefly this. All winds in these islands, and apparently over the northern hemisphere generally, at least in high latitudes, obey Buys Ballot's law, *i.e.*, they blow so that a man standing with his back to the wind has lower barometrical readings on his left hand than on his right. This law is of course reversed in the southern hemisphere. The force of the wind is also found to be more or less proportional to the amount of difference in barometrical readings over a definite distance. This quantity is called the *gradient.*

In the report just quoted the gradients were given in hundredths of an inch of mercury per 100 geographical miles. Inasmuch, however, as 0·02 in. is equivalent to five millimetres, it seems to be an improvement to make the gradients exactly one half of their original amounts, or to calculate them as hundredths of an inch of mercury per *fifty* geographical miles. (This proportion is almost exactly equivalent to five millimetres for 100 geographical miles.)

In order to convert barometrical differences between any two stations into gradients, it is necessary to multiply them by factors depending on the distance between the stations. These factors are obtained by expressing the ratio between the unit of distance (50 geographical miles), and the actual distance between the stations, as a simple fraction.

Thus the distance from Aberdeen to Rochefort is 673 miles $\frac{50}{673} = \frac{1}{13{\cdot}4}$. The factor assumed for this distance is $\frac{1}{13}$.

Table B gives the factors for all the stations comprised in the daily weather report, and for a few in addition.

The mode of using the table is as follows:—On the 1st of February 1868, the reading at Rochefort at 8 a.m. was 30·16 in.; that at Aberdeen was 28·40 in. The difference between these two reports amounts to 1·76 in. The factor for the distance being $\frac{1}{13}$, we find 13·5 hundredths of an inch per 50 miles to be the required gradient.

---

* "Report of an Inquiry into the connexion of Strong Winds and Barometrical Differences," by Robert H. Scott. London: Potter, Poultry; and Stanford, Charing Cross.

If the difference be given in French measures (5 mm. per 100 geographical miles), we get the same result. In this case the difference is 44·8 millimetres, and $\frac{44 \cdot 8}{13} \times \frac{2}{5} = 13 \cdot 5$.

In the report "on strong winds," &c., the gradient of 12 hundredths of an inch per 100 miles was assumed as indicative of a storm, or at least of a wind force of 8 (Beaufort scale), which might be expected to blow some time within the 24 hours succeeding the time for which the gradient was calculated.

According to the new factors, this limiting gradient will be 6 hundredths of an inch per 50 miles, and there does not seem to be any reason to modify the previous assumption regarding it. The relation between the gradients and the motion of the wind is not quantitatively determined as yet, nor can it be fixed for some time to come, if indeed it will ever be possible to establish it satisfactorily.

Even if we determine hourly gradients between our observatories, it seems probable that another independent set of factors will be required, for reducing the velocities registered at the observatories to their equivalents at the sea coast, before we can state the hour at which a definite velocity begins at any observatory.

The present gradients merely give the relations of pressure at one epoch during the 24 hours, and if the barometrical column be in a state of rapid oscillation this gradient may undergo very serious alterations in its amount before the corresponding epoch is reached on the succeeding day.

It is hardly necessary to insist further on the absolute insufficiency of the 8 a.m. reports to represent completely the changes which supervene in our weather; but, taking all things into consideration, a better time could scarcely be selected for affording a daily review of the simultaneous conditions of the atmosphere.

METEOROLOGICAL TABLES.—Lastly, the tables of mean results call for a few words of explanation. The materials from which these have been calculated are the hourly tabulations furnished by the respective observatories. These figures are subjected to a careful examination at the central observatory (Kew), as described in the second annual report of the office, and any chance errors detected are set right. They are then sent in to the office for calculation and discussion. The barometrical readings are not reduced to sea level, as already explained. In fact all the means are taken directly from the instrumental records. The time is Greenwich mean time. Table I. gives the mean monthly temperature, with the maximum and minimum, and the day and hour of its occurrence. It affords similar information for the barometer. The absolute extreme readings for the year for each instrument are given in thicker type. In addition the table contains the mean monthly tension of aqueous vapour, and the resulting mean dry air pressure. These latter quantities are obtained from the difference of the monthly means of the wet and dry thermometers. Table II. gives the five-day means of the dry and wet thermometers respectively, and of the barometer.

WIND.—The Committee do not contemplate any present publication of average results regarding wind. It is quite obvious that a year is far too short a period to furnish mean data of any value for so variable an element as wind. At least five years would appear to be requisite to furnish sufficiently trustworthy information as to the mean motion of the air.

Discussions of the wind are, however, in progress with the view to their ultimate publication.

PERIODIC CORRECTIONS.—Tables of the periodic corrections for every hour of Greenwich mean time, for each five-day period, are in process of calculation. It is intended to publish these tables at intervals of five years, and thereby to afford information as to daily range in various parts of the United Kingdom.

METEOROLOGICAL OFFICE

QUARTERLY WEATHER REPORT,

1869.

January 1st. The year set in with a storm, as barometrical readings had decreased to the extent of about half an inch at Valencia, where the wind grew to a gale from S.S.E. about midnight, with a considerable rise of temperature.

In Great Britain a brisk recovery of pressure was noticeable, while temperature fell and winds were light, backing from N.W., whence they had been previously blowing. In fact the atmosphere had just regained temporary tranquillity after the serious storms of December 27th and 28th, 1868.

The new disturbance was not of much consequence, as the records of the velocity of the wind, Plate II., show.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	1 a.m.	S.S.E.	5 a.m.	S.S.E.	44	5	10 a.m.	S.S.E.	9	6–8 a.m.	S.S.E.	45	—
Armagh -	—	—	—	—	—	—	—	—	2	11 a.m.	S.S.E.	32	Breeze rather strong and unsteady about noon.
Glasgow -	5 p.m.	S.S.E.	—	—	—	—	9 p.m.	S.S.E.	4	8 p.m.	S.S.E.	34	—
Aberdeen -	2 p.m.	S. by E.	10 p.m.	S. by E.	41	1	1 a.m. (2nd)	S. by E.	11	10 p.m.	S. by E.	41	—
Sandwick -	9 a.m.	S.E. by E.	1 p.m.	S.E. by E.	44	10	Midnight	S.E.	15	8 p.m.	S.E. by E.	48	—
Falmouth -	11 a.m.	S. by E.	—	—	—	—	9 p.m.	W. by N.	10	6 p.m.	S.	37	—
Stonyhurst -	—	—	—	—	—	—	—	—	2	10 p.m.	S. by E.	33	Breeze strong and squally towards midnight.
Kew -	—	—	—	—	—	—	—	—	—	Midnight	S. by W.	26	—

Note.—The anemograms at Armagh and at Sandwick Manse, near Stromness, do not appear in the Plate. *See* Introduction, p. iii.

The gale was felt principally along the English Channel, where it brought heavy rain, with a sudden increase of temperature. It would appear from the foregoing table that the northern stations were under the influence of a disturbance somewhat different from that felt in the south, as the storm began at Sandwick earlier and lasted longer than it did at Falmouth. Pressure on the whole was not seriously affected on this day, but at midnight the barogram at Kew showed that a depression was in progress, which reached a maximum at about 2.30 a.m., when the wind shifted suddenly from S. to W., with a sudden fall of temperature.

January 2nd. At 8 a.m. a rapid decrease is observed in the Valencia barogram, Plate I. indicating the approach of a fresh barometrical oscillation. The minimum was reached at 5 p.m., accompanied by a fall of 8° in temperature in 10 minutes, when a sudden access of pressure may be noticed, and a "veer" to S.W. from S. in the wind.

The same phenomenon occurred at Armagh, at 8 p.m., and is noticed at Glasgow at 11·45 p.m., but without any very marked effect on temperature at either station.

It is scarcely traceable elsewhere, except at Stonyhurst, where at 7 a.m. on the 3d it appears both in pressure and temperature.

The wind had nowhere veered much further than to W., and it backed quickly at western stations, giving the following data at the observatories:—

Observatories.	VELOCITY, 30-40 Miles per Hour.		VELOCITY Exceeding 40 Miles per Hour.				VELOCITY Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	MAXIMUM VELOCITY.			Remark.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	6 a.m.	S.E.	8 a.m.	S. by E.	46	9	8 p.m.	S.S.W.	14	3 p.m.	S. by E.	52	—
Armagh -	4 p.m.	S. by E.	—	—	—	—	7 p.m.	S.S.W.	3	5-7 p.m.	S. by E.	35	—
Glasgow -	8 p.m.	E.S.E.	—	—	—	—	11 p.m.	S.	3	10 p.m.	S.	36	—
Aberdeen -	8 p.m.	S. by E.	9 p.m.	S.S.E.	43	4	2 a.m. (3rd)	S. by E.	6	Midnight	S.S.E.	45	—
Sandwick -	6 p.m.	S.S.E.	8 p.m.	E.S.E.	47	6	3 a.m. (3rd)	S. by E.	9	11 p.m.	S.E. by S.	52	—
Falmouth -	3 p.m.	S. by W.	1 a.m. (3rd).	S.S.W.	46	3	3 a.m. (4th)	W.S.W.	36	3 a.m. (3rd).	S.S.W.	51	—
Stonyhurst -	9 p.m.	S.	—	—	—	—	6 a.m. (3rd)	S.	9	10 p.m.	S.	35	—
Kew - -	4 a.m. (3rd).	S.W. by S.	—	—	—	—	10 a.m. (3rd)	S.W. by S.	6	8 a.m. (3rd).	S.W. by S.	39	—

January 3rd. The daily report showed at 8 a.m. an area of low barometrical readings (about 29·2), embracing Ireland and Scotland. In France the barometer was much higher, but the maximum pressures reported were those from the Adriatic and from Russia.

Captain Watson of the "Palmyra" reports that from 7 a.m. to 5 p.m. he experienced a gale from S. veering to W. in the latitude of Valencia, while running from longitude 13° 55″ W. to the Irish coast.

This strong wind set in from S.W. at Valencia at 8 a.m., and lasted until midnight, but the velocity only exceeded 40 miles an hour for three hours at noon, when the direction was S.S.W. At Armagh the velocity of 30 miles was attained from S.W. from 1–3 p.m. At no other observatory was any considerable change of wind noticed.

The storm of the previous day lasted during the forenoon in the Channel, as the preceding table shows, causing a heavy sea, and in the afternoon the disturbance reached Norway, producing a serious easterly gale.

January 4th. Pressure rose steadily at all stations, every trace of the previous commotions having disappeared from the chart. The sea, however, continued rough on the Irish coast.

The increase of pressure continued up to the afternoon, when a rapid fall took place at Valencia about 4 p.m., reaching the British stations towards midnight. The rate of fall was most rapid in the north.

January 5th. Fig. 1. The reading at Nairn at 8 a.m. was 28·98, that at Rochefort being 30·28 inches, so that the gradient between these stations (*see* Table B.) was as much as 9·2. A fresh S.W. gale prevailed all over these islands and the north of France. The minimum passed Valencia at 6 a.m., Armagh at 7, Glasgow at 10, Stonyhurst about 11, and Aberdeen at 1 p.m. It was much less marked at Falmouth and Kew. The disturbance passed away rapidly, readings to the eastward being but slightly influenced by it; however, at Skudesnaes it blew hard from the east during the afternoon of the 5th. Pressure in Spain continued extremely high throughout the whole time.

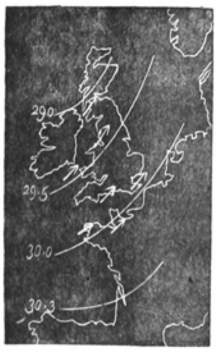


Fig. 1. Jan. 5.

NOTE.—The arrows represent strong winds of force 8 and upwards, Beaufort scale. Winds of less force are not entered.

(*See* Introduction.)

January 6th. Fig. 2. A sudden recovery of pressure occurred, with light westerly winds and finer weather. When we compare fig. 1 with fig. 2, we see that while the general direction of the isobaric curves was from S.W. to N.E. in fig. 1, it changed to a course from W. to E. in fig. 2. The curve for 30 inches appears on the 6th nearly in the position occupied by that for 29 inches on the 5th. Pressure being uniform and gradients small on the 6th (that from Rochefort to Nairn being reduced to 4·4), the gale had entirely ceased, except in the Orkneys, where strong southwesterly breezes were felt during the whole day.

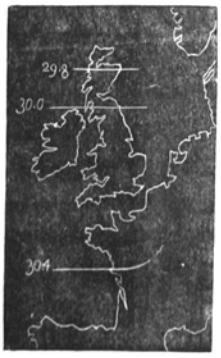


Fig. 2. Jan. 6.

The wind reports for the entire storm beginning on the 4th are as follows:—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	4 a.m. (4th)	S.W.	7 p.m. (4th).	S.S.E., veering to S.W.	52	13	8 a.m. (5th)	W.N.W.	28	2–4 a.m. (5th).	S.	55	—
Armagh -	11 p.m. (4th).	S.S.E.	—	—	—	—	7 a.m. (5th)	S.W. by W.	8	1 a.m.	S. by E.	39	—
Glasgow -	4 a.m. (5th).	S.S.E.	1 p.m. (5th).	W. by N.	48	4	5 p.m.	W. by N.	14	3 p.m.	W. by N.	53	—
Aberdeen -	5 a.m. (5th).	S.S.E.	3 p.m.	W. by N.	47	2	6 p.m.	W.	8	3 p.m.	W. by N.	50	At noon the wind lulled to 12 miles an hour at S., and at 2·30 suddenly shifted to W.N.W., blowing a heavy squall.
Sandwick -	5 a.m. (5th).	S.E.	7 a.m. 4 p.m.	S.E. W.N.W.	40 41	3 3	6 a.m. (7th)	W.	5 41	4 p.m.	W.N.W.	44	At noon a lull took place similar to that at Aberdeen, and the subsequent increase of the gale was at 2 p.m. The shift of wind was more gradual, and occurred between 1–2 o'clock, and the change of direction from S.S.E. to W.N.W.
Falmouth -	10 p.m. (4th).	S.S.W.	4 a.m. (5th).	S.S.W.	45	10	2 p.m. (5th)	W.	17	6–8 a.m.	S.S.W.	50	—
Stonyhurst -	2 a.m. (5th).	S.	6 a.m.	S.	45	2	9 a.m.	S. by W.	7	7 a.m.	S.	50	—
Kew - -	6 a.m. (5th).	S.S.W.	Noon	S.W.	43	1	3 p.m.	W.S.W.	10	Noon	S.W.	43	—

The "Cuba," Captain Moodie, ran into this gale in latitude 51° and longitude 12° 27′ at 5 p.m. on the 4th, and it lasted 12 hours from S.S.W. veering to W., while she made 2½ degrees of longitude to the westward. The "Palmyra" in the Irish Channel on the 4th escaped it entirely.

Barometrical readings continued very high in France and Spain up to the evening of the 7th, but then they began to give way.

January 8th. A stiff westerly gale passed over the north of Norway, while an easterly current forced a passage across the Bay of Biscay, and the winds in Ireland and Scotland swept in an anticyclonic course round the area of barometric elevation, which was situated over Normandy. They had freshened considerably from the southward on the west coast of Ireland during the afternoon of the 7th, when we have Valencia reporting an average velocity of 36 miles an hour for 7 hours from 6 p.m. The wind increased again after noon on the 9th in the south-west, as we find Valencia reporting a strong breeze from S.E., lasting, with an average velocity of 34 miles an hour, for 34 hours, viz., from noon on the 9th to 10 p.m. on the 10th, and occasionally blowing 40 miles an hour on the night of the 9th. The anemograms, Plate IV., show that this disturbance was confined to our south-west coast. At Falmouth the breeze freshened from E.S.E. at 8 p.m. and lasted for nine hours with about equal force to what it had at Valencia.

There was no serious variation in pressure on the 9th, but January 10, at 8 a.m., the isobars over Western Europe had assumed a totally changed course, running nearly due north and south, as a considerable decrease was in progress in Ireland. This disturbance was not of much consequence, and winds remained light until midnight on the 11th, when they again freshened to a moderate gale, lasting almost without intermision for 66 hours. The observatory statistics for the next few days are subjoined.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 p.m. (11th).	S.S.E.	11 p.m. (13th).	S.E.	45	15	6 p.m. (14th)	S.E.	67	8–10 a.m. (14th).	S.E.	52	The direction was remarkably constant throughout the gale; at 6 p.m. on the 14th the wind fell light, and at 7.30 p.m. shifted suddenly to N.N.W. and back to W.N.W., whence it blew hard from 1–5 a.m. (15th).
Armagh -	9 a.m. (14th).	S.E. by S.	1 p.m.	S.E.	43	1	4 p.m. (14th)	S.E. by S.	7	1 p.m.	S.E.	43	—
Glasgow -	—	—	—	—	—	—	—	—	—	10 p.m. (14th).	E.	21	—
Aberdeen -	—	—	—	—	—	—	—	—	—	6 a.m. (15th).	S.S.E.	36	Clock stopped at noon (13th), set going 2 p.m. (14th), when the wind was S.E. 34 miles an hour. This strong breeze lasted at about the same velocity until 9 a.m. on the 15th.
Sandwick -	8 a.m. (14th).	S.E. by S.	3 p.m.	S.E.	40	3	9 a.m. (15th)	S.E.	25	5 p.m.	S.E. by E.	41	—
Falmouth	2 p.m. (14th).	S.S.E.	—	—	—	—	7 p.m.	S.	5	5 p.m.	S.S.E.	37	The lull in the velocity took place at about the same hour as at Valencia, but the subsequent shift at Falmouth was more gradual, and only extended to W.S.W.
	11 p.m. (14th).	S.W. by S.	1 a.m. (15th).	W.S.W.	41	2	8 a.m. (15th)	W.	9	2 a.m.	W.S.W.	42	
Stonyhurst -	—	—	—	—	—	—	—	—	—	11 p.m. (14th).	E.S.E.	20	—
Kew -	—	—	—	—	—	—	—	—	—	2 a.m. (15th).	S.	24	—

Throughout the 12th and 13th the wind remained light at all stations except Valencia, but on the 14th the storm extended to Great Britain, and the velocity registered in Guernsey by Dr. Hoskins averaged 43 miles per hour during that day.

The changes of pressure during this period were very interesting; the barometer fell steadily at Valencia throughout the 13th, and at midnight Captain Cook in the

"Russia," in 51° 12′ N. and 17° 5′ W., reports his barometer reading as 29·15, with a moderate southerly wind, which backed three points and blew a heavy gale by 5 a.m.

January 14th. The diagram shows the distribution of pressure at 8 a.m. The barometer on board the "Russia" reached its lowest point, 28·835, about 1 p.m. in long. 12° 42′, lat. 51° 27′, and at 2.30 p.m. the wind, which had been blowing a heavy southerly gale since midnight, veered to N.W. The "Palmyra" in 51° and 13° reports her lowest reading 28·596 before 3 p.m., when the southerly gale lulled and suddenly shifted to N.W. (force, 9). Mr. S. W. Hodding in the "Indus," in nearly the same longitude, and about 5° to the southward, in the latitude of Rochefort, reports his lowest barometer reading 29·494 at 7 a.m., but the shift of wind to N.W. was gradual and took place during two hours about noon. He did not experience a serious gale. It is evident that these changes of wind are in connexion with those above noticed at the observatories.

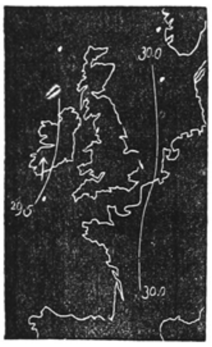


Fig. 3. Jan. 14.

The barometrical hollow passed Valencia at 7 p.m., coinciding with the shift of wind to N.W. This oscillation passed over all the observatories, but was only sharply defined at Falmouth, where the rate of decrease quickened during the afternoon of the 14th, and the minimum and shift of wind were noticed at 7 p.m., *almost simultaneously with their occurrence at Valencia.* The gale moderated with the "Palmyra" at 9 p.m., while the "Russia" carried it with her in the Irish Channel up to 10 a.m. next day.

January 15th. The area of depression was over the Irish Sea, and the winds were sweeping round it, but the gradients were not steep on the north-west side, so that very light breezes were reported.

At Valencia, however, the wind backed again to S.E. and freshened to a strong breeze at 6 p.m. At 8 it increased to a gale and lasted for nine hours, veering to S., with a mean velocity of 42 miles an hour, finally dying down at S. at 9 a.m. 16th; and at Sandwick a similar gale set in two hours later, at 8 p.m., reaching the velocity of 43 miles an hour at 3 a.m. and 50 miles at 8 a.m. The velocity for 10 hours was 45 miles, and the direction steady at S.E. The velocity fell to 27 miles an hour at 6 p.m. At Aberdeen a fresh S.E. breeze was felt throughout the 15th, increasing to 30 miles an hour at 2 a.m. 16th, and lasting for nine hours at about that velocity from S.S.E. This southerly wind was felt by the "Palmyra," in long. 16°-17°, as a fresh breeze during the morning.

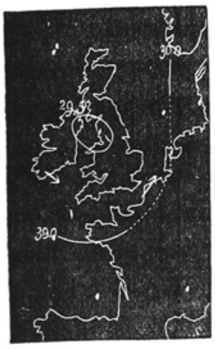


Fig. 4. Jan. 15.

Throughout the whole of this period pressure was entirely undisturbed in Norway, where, as in these islands, winds were mostly S.E.

Temperature was remarkably uniform, about 45°, but the thermograms show the great decrease in humidity which accompanied the N.W. winds, especially at Valencia and Falmouth. Rain was heavy in the south and west.

January 16th. The area of reduced pressure had entirely disappeared from our coasts, where heavy rain continued. A noticeable depression of temperature occurred at Kew in the early morning hours of the 16th, without any corresponding change of wind. At Armagh the temperature rose quickly during the day, reaching a maximum between 2 and 3 p.m. The wind veered from S.S.E. to S. at noon, and to S.S.W. at 3 p.m., backing again suddenly to E.S.E. by 11 p.m. At Aberdeen a remarkable dip is noticeable in the barogram between 3 and 4 p.m., without, however, any effect being traceable in the wind record. At Glasgow a slight fall of the barometer occurred at 1 p.m., accompanied by a temporary shift of wind to north and some unsteadiness of temperature. On the 17th the gale reached Norway. On the 16th the very remarkable barometrical reading of 796·2 mm. (31·253 in.) was registered at St. Petersburg from 4 to 10 p.m., with calm, and a temperature of –6° F.

In these islands there was no change of consequence to report during the next few days. Pressure increased generally, and the wind continued rather variable and moderate in force; weather was uniformly wet. At Valencia, however, there was another slight gale from S.E. veering to S., and lasting from 9 p.m. on the 17th to midnight on the 18th. The velocity from S. for 11 hours from 1 a.m. was 40 miles an hour. At Sandwick also there was a fresh breeze from S.E. during the evening of the 18th.

January 19th. The wind at Valencia backed to S.E., and freshened again in the afternoon to a stiff gale, blowing from 6 p.m. for 11 hours with a velocity of 46 miles an hour.

January 20th. A slight decrease of pressure was noticeable in Ireland which travelled eastwards without causing much wind; next day winds were light and continued so till the evening of the 22nd. The most remarkable point about this weather was the unsteadiness of temperature at Kew on the 19th and 20th, during which time there was a night frost, not observed elsewhere. The air over Russia continued calm with hard frost and very high pressures.

January 22nd. On this day the barometer in Norway began to fall, while a decrease had set in likewise over these islands, being greatest in the south-west. It apparently moved towards the S.E. over France, affecting our northern and eastern stations in a less degree. Winds were not much disturbed by it; however, both at Valencia and Falmouth they veered to S.E., and freshened before midnight on the 22nd. At Valencia the velocity of 30 miles from that point was attained for three hours, from 4–7 a.m. on the 23rd, the wind subsequently during the day being very unsteady, backing to N.W. and freshening again about 10 p.m. At Falmouth the vane was more steady, the maximum velocity was 32 miles, for six hours from 5 to 10 p.m. (23rd). The direction was S.E. backing steadily to E., and at 8 a.m. next morning suddenly backed further to N. causing a temporary fall of nearly 4° in temperature.. At the other stations the winds scarcely changed.

From this to the 25th there was little to remark. Weather in Great Britain was dry and rather cold, but in Ireland much warmer, with heavy rain. Pressure in Norway decreased gradually day by day; however, on the 24th from 7 p.m. to midnight the wind at Valencia suddenly freshened to a velocity of 32 miles an hour from S.S.E., while the barometer showed no signs of disturbance. On the 25th Captain Harrison in the "Aleppo," approaching the Irish coast, reported "heavy cumuli in the west" in the afternoon.

January 26th. This afternoon a slight depression passed across Scotland, reaching Glasgow at 3.45, and Aberdeen at 6 p.m.; it was not noticeable at any other stations, except Armagh and Stonyhurst, where, however, its effect was very small. The only effect on wind was a temporary veer to west and a stiff breeze for a few hours, blowing with a velocity of 35 miles in the Orkneys for seven hours from 7 p.m. It will be seen that temperature was rather unsteady, especially at Aberdeen, and during the day it rose over Great Britain.

As regards pressure, Captain Murphy, of the "Tarifa," homeward bound, in 51° 27′ N., 16° 43′ to 15° 14′ W., records a fall of the barometer of 0·4 inches from 5 p.m. to 1 a.m. (27th), with a freshening southerly wind. Later in the evening the barograms show a decrease at the western stations, the wind at Valencia backing to S.E. at 8 p.m. and increasing to a gale at midnight, which lasted for 14 hours, at a mean velocity of 46 miles an hour, veering steadily to south, at which point it moderated at 8 p.m. (27th).

January 27th. Fig. 5 shows the distribution of pressure at 8 a.m. on this day. The barometrical readings were nearly equal at Valencia, Nairn, and Skudesnaes, while they were about half an inch higher in central France. The only gale blowing was that just noticed, on the west coast of Ireland, which scarcely extended beyond the Irish Channel; Falmouth and Glasgow experienced a similar shift of wind to that at Valencia, but the velocity of 30 miles was only reached for three hours at Falmouth about midday, January 27th.

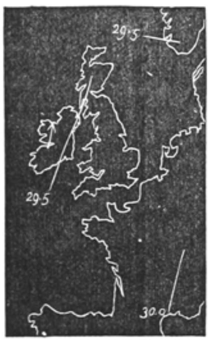


Fig. 5. Jan. 27.

The observer at Holyhead reported a gale during the day, but the "Tarifa" did not feel a higher force than 7 in squalls. The disturbance can scarcely be said to have affected Stonyhurst or Aberdeen, beyond producing a slight unsteadiness in the wind. It then died down gradually and a temporary lull ensued, while pressure continued to decrease pretty briskly in the north.

January 28th. Fig. 6 shows a considerable change in pressure and wind at 8 a.m. from the previous morning. At Nairn the reading is 29·08, and the fall has amounted to about 0·4 inches at most stations. The wind is very light from the westward. At noon, however, a rapid decrease showed itself at the Irish stations and advanced towards E.N.E., the minimum being registered at Valencia at 6.30 p.m., Falmouth 9 p.m., Armagh 11 p.m., Stonyhurst 1 a.m. (29th), Glasgow about 1.30 a.m., Kew 4 a.m., and Aberdeen 5 a.m. These data give a mean direction of propagation of the disturbance from W.S.W. to E.N.E., but in the absence of any knowledge of the actual shape of the wave, a calculation of its velocity would have little value.

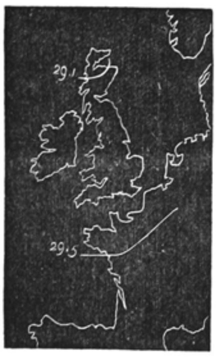


Fig. 6. Jan. 28.

The thermograms show a sudden increase of temperature, followed by as rapid a fall, especially noticeable at Kew and Stonyhurst. This was coincident with the passage of the barometrical minimum at most stations. At Falmouth the two phenomena were not quite simultaneous, and at Aberdeen the fall did not occur.

One remarkable fact, however, deserves notice, which is, that at 6 p.m. Captain Martyn, in the "Siberia," a most trustworthy observer, records the reading of 28·022 in 51° 33′ N., longitude 14° 10′ W., whereas the lowest readings registered at our observatories, when reduced to sea level, were 28·410 at Valencia at 7 p.m., and 28·437 at Armagh at 11 p.m. This appears to prove that the depression was in process of being filled up as it approached our coasts, as its amount diminished by 0·39 inches, while it travelled from the "Siberia's" position to the Irish coast. The Scotch readings were not so low as the Irish, and they show a progressive increase of pressure in an easterly direction.

The wind reports were remarkable. At noon Captain Hayes, in the "Cassini," about 150 miles W.S.W. of Cape Finisterre, felt a gale from S. to W., and at the same time the wind at Valencia backed to E.S.E., and began to blow a heavy gale at once. The same shift of wind extended to all the other stations simultaneously with the quickening of the rate of fall of the barometer.

The following are the records of this gale:—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour,		Total No. of Hours the Vel. above 30 mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 a.m. (28th).	S.E. by E.	Noon	E.S.E. veering to S.W.	49	36	6 a.m. (30th).	S.W.	44	1 p.m. (29th).	S.	58	At noon (29th) the wind backed slightly from S.S.W. to S., blowing very hard for two hours, and then veering further to W.S.W.
Armagh -	6 p.m. (28th).	E.N.E.	7 p.m.	E. by N.	41	1	1 a.m. (29th).	S.S.W.	7	7 p.m. (28th).	E. by N.	41	During the first period the wind veered quickly from E.N.E. to S.S.W., then backing slightly to S., and veering slowly to W.S.W.
	Noon (29th).	S.	7 p.m.	S.S.W.	42	1	3 a.m. (30th).	W.S.W.	16	7 p.m. (29th).	S.S.W.	42	
Glasgow -	1 a.m. (29th).	S. by E.	—	—	—	—	3 a.m. (29th).	S.W. by S.	2	9 a.m. (30th).	S.W.	43	As at Armagh, the wind at first veered quickly from E. to S.S.W., backing to S. by noon on the 29th.
	Noon (29th).	S.	7 a.m. (30th).	S.W.	43	2	2 p.m. (30th).	S.W.	27				
Aberdeen -	—	—	1 a.m. (29th).	S.E.	41	2	4 a.m.	S.	4	2 a.m.	S.S.E.	41	The wind at first veered from S.E. to S.W., backing again to S. as at the other stations.
	8 p.m. (29th).	S.	—	—	—	—	11 p.m.	S.	3	—	—	—	
	6 a.m. (30th).	S.S.W.	7 a.m. (30th).	S.W.	42	8	7 p.m.	S.W. by W.	13	1 p.m.	S.W. by W.	46	
Sandwick -	1 a.m. (29th).	E.	—	—	—	—	4 a.m.	E.S.E.	3	—	—	—	The wind veered steadily from E. to S.S.E., backing to S.E. by E. by 8 p.m., and then veering to S.W.
	8 p.m. (29th).	S.E. by E.	10 a.m. (30th).	S.W.	45	3	9 p.m.	S.W. by W.	25	Noon (30th).	S.W.	47	
Falmouth -	3 p.m. (28th).	S.S.E.	4 p.m.	S. by E.	50	5	Midnight.	S.W.	9	9 p.m.	S.	54	The wind at first veered from S.S.E. to S.W., and then backed again to S.S.W., remaining nearly steady between that point and W.S.W. to the end of the gale.
	8 a.m. (29th).	S.W. by S.	11 a.m.	S.W.	42	1	5 a.m. (30th).	S.W. by W.	21	11 a.m.	S.W.	42	
Stonyhurst -	10 p.m. (28th).	S.E. by S.	Midnight.	S. by E.	47	3	2 a.m. (29th).	S.	5	Midnight	S.S.E.	50	The shift of wind was similar to that at the other stations, but the second gale was not felt.
Kew - -	11 p.m. (28th).	S. by W.	—	—	—	—	4 a.m. (29th).	S.S.W.	5	1 p.m. (29th).	S.W.	38	The velocity during the 29th was very unsteady, sometimes reaching 30 miles an hour, and then dying down.

These data show that while the storm blew without intermission at Valencia, it lulled temporarily at all the other stations; and at Aberdeen a second lull appeared from 1 to 7 a.m. on the 30th, while the gale continued in full force at Glasgow and Sandwick.

Reverting to the ship's logs, it should be noticed that Captain Moodie in the "Cuba" in 51° 41′ N. and 16° 48′ W. at 9 p.m. experienced a shift of wind to W.N.W., while at Valencia the vane did not go beyond S.S.W.

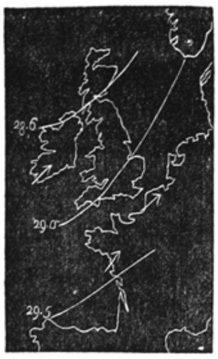


Fig. 7. Jan. 29.

January 29th (fig. 7). The isobars this morning showed an extensive disturbance, the lowest reading, 28·54, being at Greencastle; the gradient from Rochefort to this station was 8. Temperature also was remarkably unsteady at Valencia and Falmouth. The storm was chiefly felt in the Channel and on the south-coast of Ireland. During the day the barometer rose rapidly in the south, remaining comparatively steady in the north, so that the gradients became steeper in the latter district, and this was in its turn (see fig. 8.) exposed to the fury of the gale, which did not reach Norway in force till the 31st.

The "Cassini," "Siberia," and "Cuba," the first off the north coast of Spain, both the others in 12° to 16° W., and on the parallel of Cape Clear, all experienced heavy gales drawing to W.N.W.

January 30th (fig. 8). The difference between Rochefort and Nairn was 1·43 inches, and the gradient consequently 10·2. The recovery of pressure, just noticed, was, however, only temporary, as the crest of the wave passed the observatories at the following times:—Valencia, 9·15 a.m.; Falmouth, 11 a.m.; Armagh and Stonyhurst, 2·30 p.m.; Kew, 4·30 p.m.; Glasgow, 6 p.m.; Aberdeen, 10 p.m. The direction of its advance was more northerly than that of the depression two days previously. A fresh diminution set in at once in the west, and the equatorial current began to blow hard, and lasted all day on the 31st, a very heavy gale raging in the Bay of Biscay on the morning of the 1st of February. This second hollow was not nearly so abrupt as that which had preceded it. The minimum passed the three western stations—Valencia, Falmouth, and Armagh, as well as the "Cassini"—shortly after midnight, Kew and Stonyhurst about four hours later, but was much less marked at the Scotch stations, which hardly felt the gale.

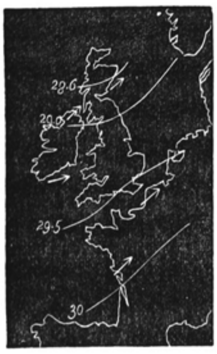


Fig. 8. Jan. 30.

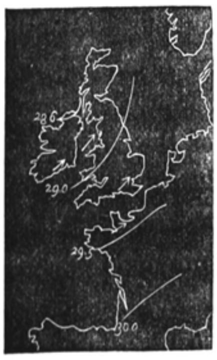


Fig. 9. Jan. 31.

January 31st (fig. 9). The isobars this morning show scarcely a trace of the oscillation we have just recorded. It would seem from them as if the original area of depression had recoiled slightly to the westward. The lowest reading is 28·56 at Greencastle, giving a gradient of 10 from Rochefort.

The gale blew very hard indeed at Valencia, not falling below 50 miles an hour from 4 p.m. (30th) to 2 p.m. 31st. The "Cassini," off Rochefort, the only one of the ships just noticed which was near our coasts, records a southerly gale beginning at 4.30 p.m. 30th, and lasting till 8 a.m. next day, when she was in mid-channel between Land's End and Ushant.

The observatory records are as follows:—

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 0 mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	10 a.m. (30th).	S. "backing."	2 p.m.	S.E. by E. veering to S.S.W.	58	24	3 p.m. (31st).	S.S.W.	29	2–4 a.m. (31st).	S. by W.	70	The velocity did not fall below 60 miles an hour for 11 hours, from 11 p.m. (30th).
Armagh	(?)	S.E. by S.	10 a.m. (31st).	S.S.W.	41	5	5 p.m.	S.S.W.	(?)	4 p.m.	S.S.W.	47	The clock stopped, and the velocity was not recorded for 12 hours prior to 10 p.m. (31st), when the breeze was very strong from S.E. by S. The wind was very gusty throughout the gale.
Glasgow	10 a.m. (31st).	S. by W.	1 p.m.	S. by W.	42	4	7 p.m.	S. by W.	9	3 p.m.	S. by W.	45	—
Aberdeen	—	—	—	—	—	—	—	—	—	6 p.m. (31st).	S.W. by S.	28	—
Sandwick	—	—	—	—	—	...	—	—	—	Noon (31st).	E. by S.	15	—
Falmouth	2 p.m. (30th).	S.	4 p.m. (30th).	S. by E. veering to S.W.	47	16	10 p.m. (Feb. 1st).	W.	56	11 p.m. (30th).	S. by E.	57	The wind at first backed slightly from S., blew hardest from S. by E., and at midnight (30th) began to veer to S.W., reaching that point by 5 a.m. It then backed again slowly to S.S.E. by 9 p.m., and ultimately veered steadily to W.
			9 p.m. (31st).	S.S.E, veering to S.S.W.	46	3							
Stonyhurst	9 p.m. (30th).	S.	11 p.m.	S.	41	3	4 a.m. (31st).	S.	7	2 a.m.	S.	42	The wind freshened again in the afternoon of the 31st from S.S.W.
Kew	9 p.m. (30th).	S. by W.	—	—	—	—	1 p.m. (31st).	S.W.	16	4 a.m. (31st).	S. by W.	36	The changes of wind were similar to those at Falmouth.
	midnight (31st).	S.S.W.	1 p.m. (Feb. 1).	S.W.	42	1	3 p.m. (1st).	S.W.	16	1 p.m. (Feb. 1).	S.W.	42	

Between the 31st and 1st another barometrical hollow passed over our stations, exhibiting a very remarkable peculiarity, which will be evident on inspection of Plate XIII. At all the Irish and Scotch observatories, as well as at Kew, the curve was a simple one, no serious check to the fall and subsequent rise of the mercurial columns being perceptible; while we find that at Falmouth and Stonyhurst there was such a check, occurring about the time that the depression advancing from the westward reached the west coast of France. At Falmouth the first minimum passed at 10 p.m. (31st), and the second at 7 a.m. (1st); and at Stonyhurst similar phenomena were noticed, but in a less marked way, and about four hours subsequent to their occurrence at Falmouth. At Kew, as before said, the curve exhibits only one point of contrary flexure. As regards the wind, the passage of the first depression at Falmouth was marked by a "back" of the wind to S. by E. and a sudden freshening from 30 to

45 miles an hour. After the second depression had gone over the wind began to veer to W. At Stonyhurst the first recovery of pressure recorded itself on the anemograph by a temporary "veer" from S.W. to N.W., but without any increase of velocity; the second minimum was without effect on the wind.

Feb. 1st (Fig. 10.) The isobars for this day again fail to exhibit in any way the modifications which pressure has undergone. In fact, the entire period from January 27 to February 2, affords most conclusive proof of the errors which must necessarily be introduced if the history of these storms were to be compiled from the daily Telegraphic Reports alone. Rainfall throughout the gale was very heavy, especially on our south coasts.

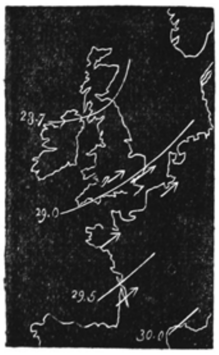


Fig. 10. Feb. 1.

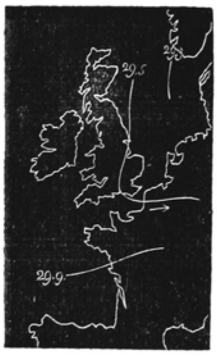


Fig. 11. Feb. 2.

Feb. 2nd (Fig 11). The depression had advanced to the Baltic, readings in Scotland having risen nearly an inch. Our winds had moderated and veered to W. and N.W., but rain still continued, while weather became much colder. At Falmouth, at noon, a sudden temporary chill occurred, with scarcely any effect on the wind. At 10 p.m. the wind at Valencia freshened to the velocity of 42 miles an hour from S. for seven hours, reaching that of 50 miles for an hour after midnight. At Falmouth a similar freshening to 30 miles an hour from S.W. occurred for six hours from 7 a.m. on the 3rd.

Pressure was unsteady during the 2nd and 3rd, a depression passing Armagh at 6 a.m., and Stonyhurst at 8 a.m., on the latter day, but being much less marked elsewhere, in fact scarcely noticeable at Aberdeen. On the whole, however, a definite area of low pressure passed over us, becoming much more serious on the coasts of Norway, where heavy gales were felt about the Loffoden Islands. Temperature rose pretty briskly during the next two days, with heavy rain and a calm sea. Winds were equatorial and fresh, blowing a gale at Valencia from S.S.E. and S. for 57 hours from 7 p.m. on the 3rd, with a mean velocity of 42 miles an hour. This consisted really of two separate gales, for there was a temporary lull for four hours at 8 a.m. Feb. 5, after which the wind backed again to S.E., and then veered to S.W. during the next 18 hours. The gale travelled northwards, being scarcely felt at any other station except Glasgow, where it freshened from S. to 40 miles an hour for two hours at 6 a.m. (5th), and again increased from the same quarter just before midnight, the vane meanwhile having gone to S.W. and back again. At Sandwick the average hourly velocity was 37 miles from S.W. for six hours from 11 a.m. on the 5th.

There is but little information available for this period from ships' registers. However, Capt. Woolward, in the "Douro," outward bound to the West Indies, experienced a southerly gale, on the nights of the 4th and 5th, while crossing the Bay of Biscay.

There was not much to remark in the general conditions of weather on the 5th and 6th, the barometer remaining nearly steady, excepting that a slight unevenness is noticed in the curve at the northern stations. At Kew the range of temperature was very considerable on both days. The wind drew into south-east over the Bay of Biscay, indicating the approach of a fresh disturbance, and the barometer began to fall at all our stations during the evening of the 6th.

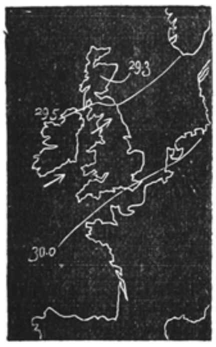


Fig. 12. Feb. 7.

Feb. 7. Fig. 12 represents the course of the isobaric lines at 8 a.m., when the minimum reading had passed over all the observatories except Aberdeen. A slight recovery then occurred, but in the afternoon the mercury commenced to fall afresh, the rate being rapid, except at Falmouth and Kew. This disturbance was remarkable, inasmuch as after the first sudden fall was over, a temporary recovery was again noticed at the northern stations, Armagh, Glasgow, and Aberdeen, while the barograms elsewhere showed a steady decrease.

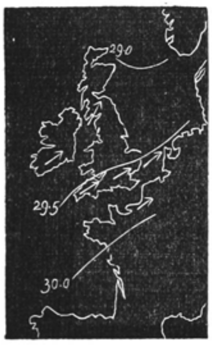


Fig. 13. Feb. 8.

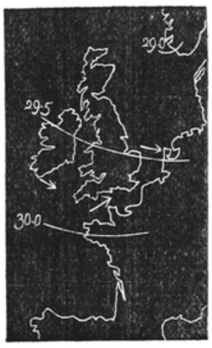


Fig. 14. Feb. 9.

Feb. 8. Fig. 13 shows us the lowest readings, of about 29·0 in. at the northern entrance of the North Sea. The isobar of 29·5 crosses central England, so that the gradients are slight in the north. Fig. 14 of the 9th exhibits the depression somewhat to the eastward of its previous position. From these figures and Plate XV. we see that an extensive hollow passed over all our stations, the first recovery from the effects of which is noticeable at Valencia in the evening of the 8th, and at the other observatories in the course of the next day.

The conditions of pressure were such that the gale was confined to the southern coasts of our islands, being scarcely felt in the north (see fig. 13). The "Cuba" and "Tripoli," off the south coast of Ireland, experienced its full force, but the storm was nowhere of great violence. The observatory records are as follows :—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	5 p.m. (6th).	S.E. by S.	3 a.m. (7th).	S.S.W.	47	42	11 a.m. (10th).	S.S.W.	91	4 p.m. (6th).	S.	60	The gale blew steadily, with some slight lulls. The direction veered suddenly to S.W. at midnight on the 6th, backed again to S., and then veered slowly to S.W. on the nights of the 8th and 9th. The gale ended at S.S.W.
			5 p.m. (9th).	S.S.W.	42	17							
Armagh -	5 p.m. (7th).	S. by W.	—	—	—	—	11 p.m. (7th)	S.S.W.	6	5-7 p.m. (7th).	S.S.W.	36	—
	Noon (8th).	S.W.	—	—	—	—	4 p.m. (8th)	S.W.	4				
Glasgow -	8 p.m. (7th).	S.S.W.	—	—	—	—	1 a.m. (8th)	W.	5	10 p.m. (7th).	S.S.W.	40	—
Aberdeen -	—	—	—	—	—	—	—	—	—	8 p.m. (9th).	W.S.W.	26	—
Sandwick -	5 a.m. (6th).	W.S.W.	—	—	—	—	3 p.m. (6th)	S.W. by W.	11	Noon (6th).	W.S.W.	40	—
	5 a.m. (8th).	W.S.W.	—	—	—	—	2 p.m. (5th)	S.W. by W.	10				
Falmouth -	10 p.m. (6th).	S. by W.	8 p.m. (9th).	S.S.W.	44	43	3 a.m. (11th)	W. by S.	101	Noon (9th).	W.	53	The direction was very constant throughout this gale. It was S.S.W. on the 7th and 8th, veered to W. on the 9th, backed to S.W. next day, and ended at W. by S.
Stonyhurst -	—	—	—	—	—	—	—	—	—	7 a.m. (9th).	W.	35	There was no gale at this station; the wind was fresh from S.W. and W., occasionally reaching the velocity of 30 miles an hour on each day.
Kew - -	8 p.m. (7th).	S.W.	—	—	—	—	1 a.m. (9th)	S.W. by W.	30	3 p.m. (8th).	S.W.	40	—

The subsequent rise of the barometer was not very rapid, so that the wind did not attain much force from points north of West. Cape Clear was the only station which reported a N.W. gale on the 9th. The equatorial current was universally prevalent on the 10th, blowing freshly over the Irish Sea and in France, and amounting to a strong breeze at Falmouth, as will be seen from the foregoing table. At the Scotch stations the wind was extremely light.

Feb. 11. There was not much to note, except that the isobaric lines spread out in a fan shape from the entrance of the channel, betraying the existence of an area of depression off the south coast of Ireland. The wind was light except at Falmouth, where, after a slight lull, it again increased to a strong breeze from W.S.W. at noon.

Towards midnight the barograms show a general decrease setting in, which was more rapid at Falmouth and Kew than elsewhere. At the latter station the wind veered suddenly from W.S.W. to E. at 5 a.m. on the 12th.

Feb. 12. Fig. 15 shows a very remarkable state of things. No great difference in barometrical readings is observable, but while the absolute minimum of pressure lies over Norway, a limited area, where the readings are below 29·9, lies across the entrance of St. George's Channel. A S.W. gale blew at Brest and Falmouth, while the wind was north-easterly at London, Roche's Point, and Cape Clear, with heavy rain at the latter stations. At Valencia there was little wind, and weather generally was not much disturbed at 8 a.m., except that a sudden fall of temperature on the east coast caused a thick fog at Yarmouth.

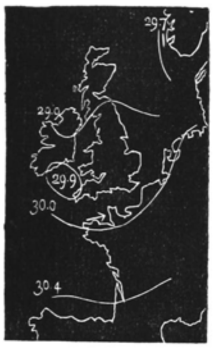


Fig. 15. Feb. 12.

Matters speedily took a very serious turn, and the barograms, Plate XVII., show most remarkable modifications of pressure.

At Falmouth the minimum was reached at noon, and the mercury rose very rapidly after its occurrence, while the temperature fell 6°·2 within a few minutes, with a sudden shift of the wind to N.W. At Kew similar phenomena are noticeable at 4.30 p.m., and at this station the subsequent rise of the barometer and fall of the thermometer were much more rapid, the latter amounting to 11°·6, and the former to 0·4 in. in an hour and a half. This disturbance is scarcely observable at any other station except Stonyhurst, where, however, it is much less marked. Its motion of translation from Falmouth to Kew was extraordinarily rapid, amounting to 45 miles an hour.

While this depression was passing off, another, somewhat resembling it, advanced to Valencia, passing that station at 5 p.m., reaching Falmouth at midnight, *but not affecting the instruments at Kew at all.*

At the other observatories these remarkable oscillations are all blended into one long hollow on the respective barograms.

The gale was very local, being confined to the channel; but from its violence and the unusual rapidity of its advance, it was very destructive, especially on the coast of Kent. Some additional particulars of interest, respecting this storm, are contained in a paper by Mr. Glaisher in the Journal of the Meteorological Society, Vol. IV., 1869.

The observatory records from Falmouth and Kew give the following data for the first gale:—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Falmouth -	Noon (11th).	W.S.W.	10 a.m. (12th).	S.W. by W.	50	4	3 p.m. (12th)	W.N.W.	27	1 p.m. (12th).	N.W. by W.	58	The wind was not very strong till it shifted to N.W., when it blew heavily for three hours.
Kew - -	2 p.m. (12th).	S.W.	—	—	—	—	6 p.m.	N.W. by N.	4	5 p.m.	N.W. by W.	38	The storm accordingly was hardly felt at Kew.

No other observatories showed this gale at all; but the reports from the telegraphic stations on the south coast of England show that the storm was serious there on the 12th:

Penzance reports N.W.$_8$ from 11·30 a.m. to 1 p.m.
Plymouth „ N.W.$_9$ 3 p.m. to 6·30 p.m. in squalls.
Weymouth „ N.W.$_{10}$ 1·30 p.m. to 3·30 p.m.
Portsmouth „ W.S.W.$_8$ at 10 a.m., veering to N.N.W.$_{10}$ at 4 p.m. and lulling there.

Yarmouth reports E at 2 p.m., backing to N.N.E.$_{10}$ at 3·30 p.m., and lasting till 8 p.m.
In Guernsey Dr. Hoskins registered an average velocity of 51 miles an hour during the day.

The supplementary disturbance had also its attendant wind-system, as the records at Valencia and Falmouth show:—

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	2 p.m. (12th).	S.W. by W.	2 p.m. (12th).	S.W. by W.	44	3	10 p.m.	N.W.	8	4 p.m.	S.W. by W.	47	The wind, after backing suddenly from N.W. to S.E., increased to a gale at 2 p.m. from S.W.
Falmouth -	9 p.m. (12th).	W.	11 p.m.	W.N.W.	45	7	7 a.m. (13th)	N.N.W.	11 ?	3–5 a.m.	N.W. by N.	48	The clock stopped for three hours at 7 p.m. (13th), when the velocity was 31 miles an hour.

At all other stations the winds were light.

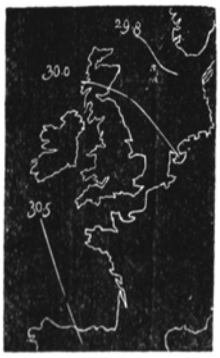


Fig. 16. Feb. 13.

Feb. 13. (Fig. 16.) Pressure shows a rapid recovery in the west, but at noon the Aberdeen barogram, Plate XVII., shows the commencement of a fall, the minimum reading being reached at 5 a.m. next day. This depression passed to the north of these islands, and is not noticeable except at the northern stations. It reached the coast of Norway during the 14th, where the absolute minimum reading 28·2 was registered at Bodö at 1 p.m. Greenwich time. The winds over these islands were seriously affected, as they were drawn into W., blowing generally a strong breeze, and with the force of a gale, in the Orkney Islands, as the subjoined table shows.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 a.m. (13th).	S.W.	—	—	—	—	11 a.m. (14th).	S.W.	24	2-4 a.m. (14th).	S.W.	40	—
Armagh -	3 p.m. 13th	S.W.	5 a.m. (14th).	S.W.	44	1	7 a.m. (14th)	S.W.	17	5 a.m. (14th).	S.W.	44	—
Glasgow -	Noon (13th).	W.	3 p.m. (13th).	W.S.W.	43	(?)	5 a.m. (14th)	W. by S.	(?)	3 p.m. (13th).	W.S.W.	43	The velocity pencil was not in action from 4 p.m. on the 13th to 2 a.m. on the 14th, so that the record of the gale is lost.
Aberdeen -	5 p.m. (13th.)	S.W. by W.	10 a.m. (14th).	W.N.W.	47	9	8 p.m. (14th)	N.W. by W.	27	1 p.m. (14th).	W. by N.	54	A lull for three hours took place on the morning of the 14th, coincident with the occurrence of the lowest barometrical readings.
Sandwick -	2 a.m. (13th).	S.W. by W.	6 p.m. (13th). 6 a.m. (14th).	W. by S. W. by S.	48 55	6 13	10 p.m. (14th).	N.W.	44	11 a.m. (14th.)	W.	68	The lull occurred as at Aberdeen, but the velocity of the wind, both before and after it, was much higher at Sandwick.
Falmouth -	—	—	—	—	—	—	—	—	—	11 a.m. (14th).	W. by S.	28	—
Stonyhurst -	10 p.m. (13th).	S.W. by S.	3 p.m. (14th).	W.	42	2	5 p.m. (14th)	W.	19	4 p.m. (14th).	W. by S.	43	—
Kew -	—	—	—	—	—	—	—	—	—	11 a.m. (14th).	W.	24	—

The storm was, however, much more severe in Norway, as Christiansund reports force 10 from W. and N.W. for 30 hours. At Skudesnaes the violence was less.

Feb. 15. The barometer had risen generally, but more rapidly at the northern stations. During the day a decrease set in at all the observatories. The winds were light in Great Britain, but southerly, in Ireland where the velocity reached 30 miles an hour at 8 a.m. The "Samaria," on her outward passage to New York, ran into this gale in long. 13° 17′ at 11 a.m.

Feb. 16. The isobaric lines ran due N.E. and S.W., the lowest (29·6) lying along the line of the Caledonian Canal, and reaching in a straight course to Galway, while that of 30 inches ran in a parallel course across central England. Temperature had risen quickly in the North, and the southerly wind freshened at Glasgow to a strong breeze at noon, without materially affecting the stations on the east coast of Great Britain.

The isobars on the 17th ran parallel to their former course, but had shifted their position some distance to the S.E.

Feb. 18. The gale died down, the gradients having become less, for the high pressures prevailing in the South had given way, while the barometer remained comparatively steady in the North and West. The wind veered generally to N.W. and temperature fell. This storm did not reach Norway at all, though the barometrical observations in that country show considerable oscillations.

The records furnished by the observatories show that scarcely any of them except Valencia felt the gale.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	7 a.m. (15th).	S.	9 p.m. (15th). 11 p.m. (16th).	S.S.E. S.S.W.	51 46	14 12	10 p.m. (17th)	S.W.	63	5 a.m. (16th).	S.	57	—
Armagh -	—	—	—	—	—	—	—	—	—	Noon (16th).	S.S.W.	32	The velocity of 30 miles was exceeded for two hours at noon on the 16th and 17th.
Glasgow -	11 a.m. (16th).	S. by W.	2 p.m. (16th).	S. by W.	40	2	4 p.m. (16th)	S.W. by S.	5	2 p.m. (16th).	S. by W.	41	—
Aberdeen -	—	—	—	—	—	—	—	—	—	4 p.m. (16th).	S. by W.	29	—
Sandwick -	—	—	—	—	—	—	—	—	—	Noon (16th.)	(?)	29	The direction record seems doubtful.
Falmouth -	10 a.m. (16th).	S. by W.	—	—	—	—	2 a.m. (17th)	S.W.	16	5 p.m. (16th).	S. by W.	34	—
Stonyhurst -	6 p.m. (16th).	S.S.W.	—	—	—	—	9 p.m.	S.S.W.	3	8 p.m.	S.S.W.	34	—
Kew -	—	—	—	—	—	—	—	—	—	9 a.m. (17th).	S.W. by S.	30	—

February 19. A steady rise of the mercury was noticeable at all stations. Next day, however, a slight depression passed over the Irish stations, becoming more marked at Falmouth, where the minimum reading was recorded at 3 a.m. on the 21st. At 8 a.m. on this day the chart shows the depression situated off the coast of Brittany, and drawing the winds at most British stations into E. At Falmouth the wind had veered suddenly from N.W. to E.S.E., and it at once began to blow a strong breeze as soon as the barometer began to rise. The velocity exceeded 30 miles for nine hours, and the direction was E.S.E., backing to E. Very light airs were felt at all the other observatories. There was no change to report during the next two days.

February 24. Before 1 a.m. the western barograms showed a brisk diminution in pressure (see Plate XXI.) and a S.W. gale set in at Valencia. This disturbance travelled very rapidly, affecting principally the northern stations. It was followed by several others, which we shall enumerate *seriatim*. The times at which the minimum readings of depression No. I. were recorded were as follows:—

Valencia, 10.30 a.m.
Armagh, noon.
Glasgow, 2 p.m.
Aberdeen, 4 p.m.
Falmouth, 4.30 p.m.
Stonyhurst, 3.45 p.m.
Kew, 7.30 p.m.

The subjoined table shows that the gale, though pretty stiff at Valencia for a few hours, was not much felt elsewhere.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	9 p.m. (23rd).	S.S.W.	3 a.m. (24th).	S. by W.	45	8	11 a.m. (24th).	W.	14	8-10 a.m.	S.S.W.	50	—
Armagh	—	—	—	—	—	—	—	—	—	2 p.m. (24th).	W.	35	The velocity only reached 30 miles an hour occasionally. The breeze was fresh during the day.
Glasgow	—	—	—	—	—	—	—	—	—	1 p.m. (24th).	S. by W.	32	The wind was similar to that felt at Armagh.
Aberdeen	—	—	—	—	—	—	—	—	—	8 p.m. (24th).	N.W.	32	The wind was fresh from S. all day, but it reached the velocity of 30 miles from N.W. after the shift of wind had occurred.
Sandwick	5 a.m. (24th).	S.W. by S.	—	—	—	—	Noon	S. by W.	7	6 p.m.	W. by N.	38	—
	3 p.m. (24th).	S. by W.	—	—	—	—	9 p.m.	W. by N.	6				
Falmouth	10 a.m.	S.W. by W.	2 p.m.	W.S.W.	40	2	6 p.m.	W.N.W.	8	2-4 p.m.	W.S.W.	40	—
Stonyhurst	—	—	—	—	—	—	—	—	—	9 p.m.	N.W.	28	—
Kew	—	—	—	—	—	—	—	—	—	7 p.m.	S.W.	28	—

During the early part of the night of the 24th the barometer rose rapidly in the north, but at midnight a fresh fall, depression No. II., set in at Valencia. This oscillation was remarkable, for while it was very slightly marked at the southern stations it was very abrupt at those in the north, especially in Scotland.

The observatory statistics show that the gale was very severe in the Orkney Islands.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind,	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	3 a.m. (25th).	S.S.W.	—	—	—	—	11 a.m.	W S.W.	8	8 a.m.	S.W. by S.	34	—
Armagh	7 a.m. (25th).	S.S.W.	9 a.m.	S.S.W.	43	1	11 a.m.	S.W. by S.	4	9 a.m.	S.S.W.	43	The wind was very gusty. The velocity at 10 a.m. was only 11 miles an hour. It increased afterwards.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Glasgow -	10 a.m. (25th).	S.W.	Noon	S.W.	43	5	7 a.m. (26th).	W.N.W.	21	Noon (25th).	S.W.	45	—
Aberdeen -	10 a.m.	S.W. by S.	—	—	—	—	Noon	S.W. by S.	2	Noon.	S.W. by S.	36	—
Sandwick -	6 a.m. (25th).	S.S.W.	8 a.m.	S.W. by S.	53	30	2 p.m. (26th).	W.	32	4 a.m. (26th).	W. by N.	67	The velocity exceeded 60 miles an hour from 2–7 a.m.
Falmouth -	9 p.m. (25th).	N.W. by W.	—	—	—	—	5 a.m. (26th).	N.W. by W.	8	1 a.m.	N.W. by W.	39	—
Stonyhurst -	2 p.m. (25th).	S.W.	—	—	—	—	Noon (28th).	W. by N.	22	5 p.m. (25th).	W.S.W.	37	—
Kew - -	—	—	—	—	—	—	—	—	—	6 p.m. (25th).	S.W.	26	—

February 25 (Fig. 21.) The isobars show a depression existing off the N.W. coast of Scotland, while pressure is high in France and Spain.

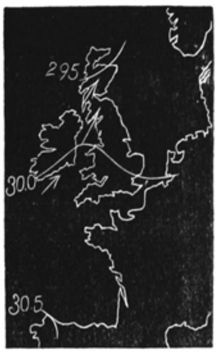


Fig. 21. Feb. 25.

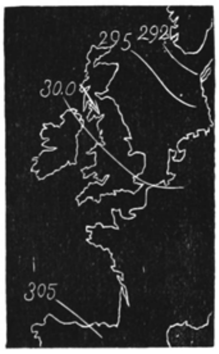


Fig. 22. Feb. 26.

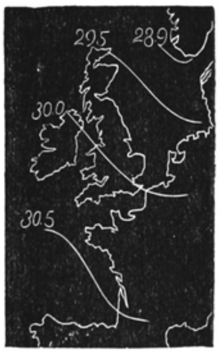


Fig. 23. Feb. 27.

Barometrical readings recovered during the day, and at 8 a.m. next morning (Fig. 22) the area of depression appears to have advanced to Norway, the minimum reading, 28·27, being recorded at Bodö at 2 p.m.

Depression No. III. came on during the night of the 26th, and, like its predecessor, was much less marked in the south than in the north.

February 27. (Fig. 23.) The appearance of the chart seems to show very slight disturbances of pressure from the previous day, but in reality, as Plate XXIII. shows, Depression No. II. had passed over our stations. This former disturbance had caused very severe westerly storms on the coasts of Norway, while at Sandwick the remarkable velocity of 81 miles an hour from N.W. by W. was registered at 4 a.m. on the 27th.

The anemometrical records show that our southern coasts escaped the storm.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	—	—	—	—	—	—	—	—	—	7 p.m. (26th).	S.W. by W.	32	The wind was fresh from S.W., but not a gale.
Armagh -	9 p.m. (26th).	S.W. by W.	—	—	—	—	1 a.m. (27th).	W.	4	11 p.m.	W.S.W.	37	—
Glasgow -	10 p.m. (26th).	S.W.	4 a.m. (27th).	W.N.W.	41	2	1 p.m. (27th).	W. by N.	15	5 a.m.	W.N.W.	42	—
Aberdeen -	1 a.m. (27th).	W.	—	—	—	—	9 a.m.	W.N.W.	8	5 a.m.	W. by N.	40	—
Sandwick -	11 p.m. (26th).	W.S.W.	11 p.m. (26th).	W.S.W.	60	6	6 a.m. (27th).	N.N.W.	7	4 a.m. (27th).	N.W. by W.	81	The velocity increased from 63 miles from W. at 3 a.m., to 81 from N.W. by W. at 4 a.m., falling again to 56 from N.W. by N. at 5 a.m. Between the two gales the velocity fell to 16 miles an hour.
	10 a.m. (27th).	W.	11 a.m. (27th).	W.	41	3	6 p.m. (27th).	W. by N.	8				
Falmouth -	—	—	—	—	—	—	—	—	—	2 p.m. (27th).	W.N.W.	31	—
Stonyhurst -	1 a.m. (27th).	W. by S.	11 a.m.	W.	42	1	1 p.m.	W. by N.	12	11 a.m.	W.	42	—
Kew -	—	—	—	—	—	—	—	—	—	11 a.m.	N.W. by N.	26	—

The area of disturbance appears to have extended gradually in a southerly direction, as the gale began at Scarborough at 2 p.m., and soon after that hour the wind increased at Valencia to the velocity of 40 miles an hour, freshening also considerably at Falmouth at 10 p.m., and extending to the French coast during the night, with snow and hail.

The observatory statistics are as follow :—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	4 p.m. (27th).	W. by S.	7 p.m.	W.	43	15	11 p.m. (28th).	W.	31	1–3 a.m. (28th).	W.N.W.	48	—
Armagh -	—	—	—	—	—	—	—	—	—	10 a.m. (28th).	W.N.W.	26	—
Glasgow -	—	—	—	—	—	—	—	—	—	1 p.m. (28th).	N.W. by W.	31	This wind only lasted for one hour.
Aberdeen -	—	—	—	—	—	—	—	—	—	1 p.m. (28th).	W. by N.	29	—
Sandwick -	5 a.m. (28th).	W.	6 a.m.	W.	43	4	7 a.m. (1st).	N.W. by N.	26	9 a.m.	W. by N.	46	—
Falmouth -	10 p.m. (27th).	W. by N.	—	—	—	—	9 a.m. (1st).	N.W. by W.	35	Midnight (28th).	W. by N.	48	—
Stonyhurst -	7 a.m. (28th).	W. by N.	—	—	—	—	Noon.	W.N.W.	5	9 a.m.	W. by N.	36	—
Kew -	9 a.m. (28th).	W.N.W.	—	—	—	—	1 p.m.	W.N.W.	4	Noon	W.N.W.	34	—

February 28 (Fig. 24). The isobars were nearly in the same position as in Fig. 23, but while the barometer had remained steady at Corunna, it had fallen over central England. The gradient from Corunna to Holyhead had increased from 4·4 on the 27th to 6·6 on the 28th, so that the increased force of wind on our south-western coasts is fully accounted for.

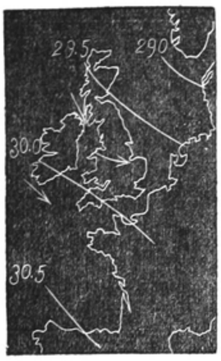


Fig. 24. Feb. 28.

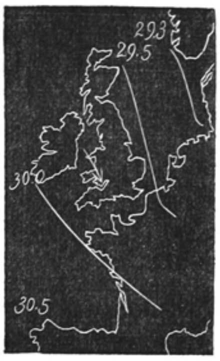


Fig. 25. March 1.

March 1. The daily chart (Fig. 25) shows a slight recovery of pressure at 8 a.m. in the north-west, but elsewhere the barometer has fallen, especially in the north of Germany.

The isobaric lines run from N.W. to S.E., and the gradient from Corunna to Helder is 7.7, so that the north-westerly winds increased (blowing a gale at Holyhead and on the French coast), and now became general.

At noon a sudden decrease appears in all the barograms (Plate XXIII.), but is much less marked at Valencia and Falmouth than at the northern and eastern stations.

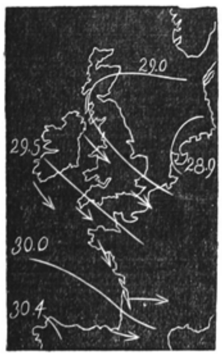


Fig. 26. March 2.

March 2. Fig. 26 shows the lowest pressure, 28.83, at Helder, so that the gradient from Corunna to that station is increased to 10. Accordingly we find that a gale from W. and N.W. has swept over these islands and is now blowing at the south-western stations and over the Bay of Biscay. The observatory records of the storm are as follows :—

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	11 a.m. (1st).	W.S.W.	11 p.m.	W.	49	17	7 p.m. (2nd).	N.W. by N.	32	10 a.m. (2nd).	W. by N.	54	The wind veered gradually from W.S.W. to N.N.W.
Armagh	—	—	—	—	—	—	—	—	—	9 p.m. (1st).	W.	30	—
Glasgow	Noon (2nd).	N.	1 p.m.	N.	45	2	4 p.m.	N.	4	3 p.m.	N.	47	—
Aberdeen	5 a.m. (2nd).	E.S.E.	6 a.m.	E.	40	1	8 a.m.	E.	3	6 a.m.	E.	40	The wind gradually backed from W. to E. and N.
Sandwick	11 a.m. (2nd).	N.	—	—	—	—	9 a.m. (3rd).	W.N.W.	22	1–3 a.m. (3rd).	N.W.	35	—
Falmouth	—	—	3 p.m. (1st).	W. by N.	50	30	5 a.m. (3rd).	N.N.W.	38	Noon (2nd).	W.N.W.	61	—
Stonyhurst	Midnight (1st).	W. by N.	—	—	—	—	Noon (2nd).	W.N.W.	12	9 a.m.	W. by N.	36	The wind was fresh during the day.
Kew	—		—	—	—	—	—	—	—	11 a.m. (2nd).	W.N.W.	33	The wind occasionally reached the velocity of 30 miles.

This table shows us that the wind was strongest and that the gale lasted longest at Falmouth. The wind was more northerly in Scotland than in the south. Snow and hail were reported from most of the stations in the north and east, with thunder and lightning in some places.

In the course of the day a very rapid rise of the barometer is noticeable at all the observatories (Plate XXV.), commencing at Aberdeen at 6 a.m., and at Kew nine hours later. At Yarmouth the wind shifted to N.E. at 5 p.m. and blew very hard for 12 hours.

March 3. (Fig. 27.) The increase of pressure has amounted to 0.9 at the Helder, and to an inch in the north of England. The absolute minimum reading is in Norway, but apparently the depression existing over Holland on the previous day has moved southwards to Toulon, causing in its passage furious north-west gales in the south of France.

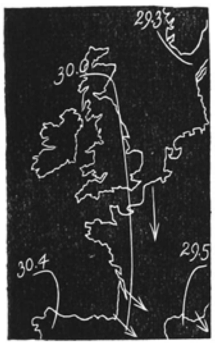


Fig. 27. March 3.

There was but little to remark during the next two days, but on the evening of the 4th a depression advanced to the northern stations, passing off during the course of the 5th.

The gale which accompanied this disturbance was very local, the only station which was affected, besides those in the north and on the east coast of Great Britain, being Falmouth, where there was a strong N.W. breeze about mid-day.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Glasgow -	2 a.m. (5th).	W.S.W.	2 p.m.	N.W.	40	3	6 p.m. (5th).	N.N.W.	18	2–5 p.m.	N.W.	40	—
Aberdeen -	9 a.m. (5th).	W. by N.	10 a.m.	W. by N.	45	7	5 p.m. (5th).	N.W.	8	1 p.m.	N.W.	48	—
Sandwick -	7 p.m. (4th).	S. by E.	11 a.m. (5th).	N.W.	48	2	7 p.m. (5th).	N. by W.	24	Noon (5th).	N.W.	50	The velocity was very irregular; 40 miles an hour was exceeded from S.S.E. at 9–11 p.m., 4th, and from N.N.W. at 3–5 p.m., 5th.
Falmouth -	Noon (5th).	N.W. by W.	—	—	—	—	4 p.m.	N.W. by W.	4	4 p.m. (5th).	N.W. by W.	36	—
Stonyhurst -	6 a.m. (5th).	W. by N.	—	—	—	—	6 p.m.	N.W. by W.	12	2 p.m.	W. by N.	38	—

March 6. The depression has entirely disappeared from our coasts, and seems, from the chart in the Bulletin International, to be now situated over central and southern Europe, as two distinct areas of relatively low pressure are represented, one on either side of the Alps.

The winds in these islands are generally from N. to N.E., and are freshest in England, especially on the east coast. Weather is dry, and temperature rather low.

March 7. A decrease of pressure is noticeable in the western barograms, and the wind had accordingly shifted to the southward, but had already veered to N.W. in Ireland by 8 a.m. During the day the barometer recovered temporarily at the south-western stations, but on the whole plate XXVII. shows that a general reduction of pressure set in at all the observatories, and by the morning of the 8th the N.W. winds had extended to the west coast of Great Britain, the area of least readings being situated off the east coast of Scotland. Over the Mediterranean also low barometrical pressures are reported, producing north-easterly winds in France and a N.E. gale at Corunna. The "Minero," Capt. Carruthers, in lat. 47° long. 15° W., also experienced a N.E. gale. In fact, the circulation over these islands and France was of an anticyclonic character, round a relative barometrical maximum lying near Valencia.

March 9. A considerable fall of the barometer had occurred along the Channel coast and in France, but pressure was remarkably uniform over Great Britain, with north-easterly winds and some snow showers. At Valencia a stiff N.N.E. breeze was reported, and a north-west gale at Corunna, which was also experienced by the "Twilight," Capt. Angel, on the coast of Portugal. The "Minero," crossing the Bay of Biscay, had severe weather from the N.E., with hail squalls and lightning.

March 10. The Bulletin International shows an area of barometrical depression (readings about 29.0 in.) over the south-west of France. The winds were generally north-easterly and moderate, but at 8 a.m. the "Minero," which had been driven down into the Bay of Biscay, reports a very heavy squally north-east gale, and the observations from Corunna support the statement.

March 11. The area of depression has advanced eastwards, and is now situated over central France. In these islands there was little change in the weather, but the strong northerly winds were still prevalent in the Bay of Biscay.

March 12. A rapid recovery is noticeable in the barometrical readings on the west coast of France, where the northerly gale still continued. In these islands there was little change of weather, temperature was low, and snow was reported from several stations. The barogram from Valencia, Plate XXIX., showed a decrease, with south-easterly winds, which freshened during the afternoon but did not attain the force of a gale. However, in the course of the evening, Mr. Greenwood, the observer on board the R.M.S. "Samaria," Capt. Lott, reports a westerly gale lasting for some hours in lat. 51°, long. 17° to 15° W. At Falmouth a strong S.E. breeze set in before midnight.

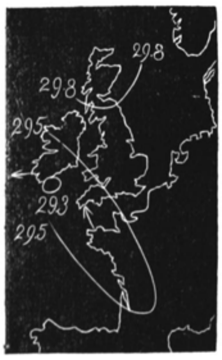


Fig. 28. March 13.

March 13. A definite area of low pressure (readings about 29·3) lay off the south coast of Ireland (Fig. 28), affecting the barometers at all southern stations, while readings in Scotland were uninfluenced by the change. The wind had all veered to the eastward by 8 a.m., and a fresh gale from that quarter was felt in the south-west, especially at the entrance of the Channel. The only observatories which were affected by it were Valencia and Falmouth, and they give us the following particulars:—

Observatories.	VELOCITY, 30–40 Miles per Hour.		VELOCITY, Exceeding 40 Miles per Hour.				VELOCITY, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	MAXIMUM VELOCITY.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	6 a.m. (13th.)	N.E. by E.	7 a.m.	E.N.E.	47	4	8 p.m. (13th)	E.	14	10 a.m.	E. by N.	50	—
Falmouth -	9 p.m. (12th).	S.E. by S.	7 a.m. (13th).	E.S.E.	40	15	Midnight (13th).	E.N.E.	27	11 a.m.	E.S.E.	45	—

Simultaneously with this easterly gale, west winds were reported on the north coast of Spain, and a heavy W.N.W. storm was blowing at Christiansund and Aalesund, but was not felt at the other Norwegian stations.

In the afternoon the barometer in Ireland began to recover briskly, and by 8 a.m. on the 14th the change in that district had amounted to about half an inch, while the lowest reading, 29·27 ins., was found at Biarritz. The winds were strong from S.E. and E. over the Bay of Biscay, while in these islands they were moderate from N.E., with cold weather and snow showers at several stations.

March 15. The centre of depression has now advanced to the Gulf of Genoa. A slight fall appears in the barograms from the Irish observatories, which is sufficient to draw the winds at the northern and western stations into S.E. The force, however, remains light, except at Valencia, where a stiff breeze was felt about noon.

March 16. A slight reduction of pressure was noticeable at all our stations, and the south-east winds extended to England. About midday, however, a very rapid decrease set in in the south-west, as is shown by the barograms for Valencia, Armagh, and Falmouth (Plate XXIX.). The wind at Valencia and Falmouth veered quickly to N.W.

March 17. The reduction of pressure had become very serious, amounting to 0·6 in. at Pembroke. A stiff N.W. gale was blowing in the south of Ireland, but elsewhere winds were light as the gradients were moderate. Heavy rain, with occasional hailstorms, was reported from the western stations.

A rapid recovery of pressure occurred during the afternoon, and by 8 a.m. on the 18th the change had amounted to from 0·6 to 0·7 in. at the south-western stations, so that no trace of the area of low readings which had existed on the previous day off the Bristol Channel was perceptible on the chart.

The winds were light, except in the south of Ireland, where the fresh north-westerly breezes still continued.

In the afternoon a slight barometrical oscillation passed over Glasgow, causing a temporary freshening of the wind from N.W. at that observatory, and a N.W. squall at Ardrossan.

At midnight the barogram at Valencia showed a very sudden decrease, Plate XXXI., and the mercury reached its lowest point at 6.45 a.m., immediately beginning to rise again, even more rapidly than it had fallen.

The wind, which had backed to S.S.E. at midnight, reached the force of a gale at 1 a.m., and shifted to N.W. at 8 a.m., blowing harder than before, simultaneously with the rapid rise of the barometer. As is to be expected, this change of wind marked itself on the thermograms by an immediate and serious fall of temperature.

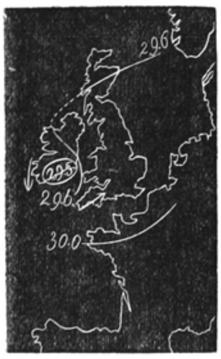


Fig. 29. March 19.

March 19. Fig. 29 shows us an area of diminished pressures on the south coast of Ireland, the reading at Roche's Point at 8 a.m. being 29·42, and the gradient from Rochefort to that station 8·2. The disturbance was very local, for the depression was much less marked at the northern stations than at those along the Channel coast; in fact it is barely traceable in the Scotch barograms.

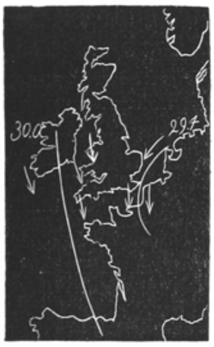
The observatory statistics of the gale are as follows:—

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	1 a.m. (19th).	S.E. by E.	3 a.m.	S.S.W.	42	8	8 p.m.	N.W.	19	9 a.m.	N.W.	50	—
Armagh -	—	—	—	—	—	—	—	—	—	Noon. (20th.)	N.N.W.	22	—
Glasgow -	—	—	—	—	—	—	—	—	—	2 p.m. (20th).	N. by W.	22	—
Aberdeen -	—	—	—	—	—	—	—	—	—	2-4 p.m. (20th).	N.W.by N.	30	—
Sandwick -	—	—	—	—	—	—	—	—	—	9 a.m. (20th).	N.W.	29	—
Falmouth -	6 a.m. (19th).	W.S.W.	8 a.m.	W.S.W.	48	36	6 p.m. (21st).	N.	60	3-5 p.m. (19th).	N.W.byW.	71	The mean hourly velocity from noon to 7 p.m. on the 19th was 67 miles, the direction W.N.W. veering to N.W.
Stonyhurst -	—	—	—	—	—	—	—	—	—	Noon (21st).	N.N.E.	24	—
Kew - -	11 p.m. (19th).	N. by W.	—	—	—	—	4 a.m. (20th).	N.N.W.	5	Midnight.	N. by W.	39	—

It appears from this statement that the violence of the storm in the south-west of England, especially after the wind had veered to N.W., was much greater than in any other district. The velocity at Falmouth averaged 71 miles an hour from 3 to 5 p.m. At 2.30 p.m. the N.W. gale reached Pembroke, and extended along the whole south coast of England during the evening, with heavy rain, while hail and lightning were reported from the western stations.

The "Mataura," Captain Bird, was off Cape Finisterre at about 8 p.m., and experienced a fresh N.W. gale during the night while crossing the Bay of Biscay. At Holyhead a gale from E.N.E. was felt, but there was scarcely any disturbance in Scotland.

March 20. (Fig. 30.) A rapid recovery has set in at our western stations, and the area of depression has advanced eastwards and is now situated over Belgium, the gradient from Valencia to Cape Grisnez being 9·1. Heavy northerly gales are reported from all our southern stations, as well as from the north and west coasts of France, and from the "Mataura" in the Bay of Biscay. The direction of the wind is N.N.E. at Yarmouth and E. at Helder.



March 20. Fig. 30.

March 21. Pressure was recovering steadily at all our stations, and the depression noticed over Belgium on the previous day had disappeared and apparently moved southwards, as low readings are reported from Italy and the south-east of France. The gradient from Corunna to Cape Sicié was 6·3, so that the wind was strong from the northward in the south of France.

March 22–24. There was but little change to be reported in the weather over the United Kingdom. Barometrical readings decreased from the west coast of Ireland, where they were about 30·4 in., to the south of Italy, where the mercury stood an inch lower. The winds were north-easterly in these islands, and the weather clear and dry. In the south of France the northerly gales gradually died down.

March 25. Pressure began to give way in the north and east, and by the morning of the 26th the change had become rapid at our own northern stations, while in Norway it was much more serious, amounting to 0·6 ins. in 24 hours at Christiansund and Aalesund: moderate W.S.W. gales were also reported from the latter station.

The following table, in which the readings are reduced to 32°, but not to sea-level, shows the progress of this depression southwards over Norway.

—	March 25.			March 26.			March 27.		
	8 a.m.	2 p.m.	8 p.m.	8 a.m.	2 p.m.	8 p.m.	8 a.m.	2 p.m.	8 p.m.
Bodö - - -	756·3	751·6	756·3	743·8	743·6	746·3	750·8	753·8	757·1
Christiansund - -	755·2	753·3	748·1	740·7	738·7	740·0	744·7	749·5	755·0
Aalesund - - -	758·3	756·0	753·8	742·3	739·9	742·1	744·8	750·4	755·5
Dovre - - -	700·4	698·3	695·5	694·8	683·5	684·3	688·6	694·2	698·1
Skudesnaes - - -	760·4	759·5	758·0	750·5	745·8	742·6	743·2	745·3	751·0
Sandösund - - -	759·4	758·5	756·8	748·8	744·9	741·9	744·9	747·9	751·5
Christiania - - -	758·6	756·7	754·3	747·1	742·0	738·5	744·5	747·7	751·6
Mandal - - -	758·6	758·3	756·8	750·8	745·3	744·0	743·1	745·6	748·6

The winds in our islands on the 26th were moderate generally, but had backed to north-west, being influenced by the barometrical disturbance which was in progress in Norway. At Sandwick Manse, however, a stiff N.W. gale was felt, as the subjoined table shows. In France the north-easterly current still held its ground.

March 27. (Fig. 31.) The greatest decrease of pressure since the preceding day was noticed at 8 a.m. along our eastern coast. The progress over our stations of the depression previously noticed, may be traced in Plates XXXIII. and XXXV. It was recorded at the Scotch stations on the 26th and 27th, while it did not reach the English observatories until the 28th.

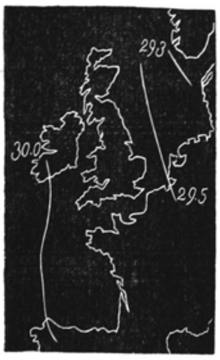


Fig. 31. Mar. 27.

At 8 a.m. the north-westerly winds were blowing with the force of a slight gale at Holyhead and Sandwick, and they extended to Aberdeen and Glasgow during the day, but did not attain much violence. At Falmouth, however, a strong N.N.W. gale set in during the early morning hours of the 28th.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Glasgow -	9 a.m. (27th).	N. by W.	—	—	—	—	3 p.m. (27th)	N. by W.	6	2 p.m.	N. by W.	40	—
Aberdeen -	11 a.m. (27th).	N.N.W.	—	—	—	—	4 p.m. (27th)	N.N.W.	5	1 p.m.	N.W.byN.	35	—
Sandwick -	Midnight. (25th).	W.	7 a.m. (26th). 8 p.m. (26th).	N.W.by N. N.N.W.	41 43	7 9	7 p.m. (27th)	N. by W.	43	Midnight (26th).	N.W.byN.	49	—
Falmouth -	Noon (27th).	N.N.W.	5 p.m.	N. by W.	41	1	9 p.m. (27th)	N. by W.	9	5 p.m.	N. by W.	41	—

March 28. Fig. 32 shows the distribution of pressure this morning. The barometer had risen briskly at Skudesnaes, while the greatest fall was in the neighbourhood of Dover. The gradients in the north and west of England were steep, as much as 11 from Leith to Scarborough, and consequently northerly gales were reported in St. George's Channel, and a heavy N.E. storm at Scarborough. Snow and hail were very prevalent.

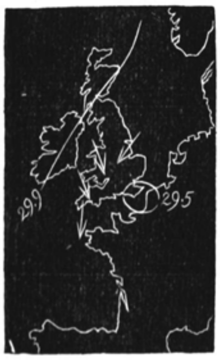


Fig. 32. Mar. 28.

During the day the barometer rose rather quickly along our east coast, so that the gradients in the south of England became very steep in their turn, and the easterly gales with their accompanying weather swept down the coast, reaching the mouth of the Thames and Dover about 4 a.m. on the 29th (Easter Monday).

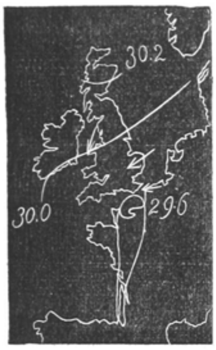


Fig. 33. Mar. 29.

March 29. The area of depression was apparently pear-shaped, and lay in a north and south direction over the west of France (Fig. 33), and it was apparently in process of being filled up. The gradient from Yarmouth to Cape Gris-Nez was 13, and the wind was blowing with great force from the eastward on the coast of Kent. In the south of the Bay of Biscay, on the other hand, strong westerly and south-west winds were felt.

The following table gives the particulars of this gale, furnished by the self-recording anemometers, and it will be seen from it that the storm was very local, being scarcely felt at any of the observatories except Falmouth.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Directiou of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	—	—	—	—	—	—	—	—	—	10 p.m. (28th).	N.N.E.	28	—
Armagh -	—	—	—	—	—	—	—	—	—	7 p.m. (28th).	N.N.E.	26	—
Glasgow -	8 a.m. (28th).	N.N.E.	—	—	—	—	4 p.m.	N.E.	8	3 p.m. (28th).	N.N.E.	37	—
Aberdeen -	8 a.m. (28th).	N.E. by N.	—	—	—	—	4 p.m.	E.	8	Noon (28th).	N.E. by E.	34	—
Sandwick -	—	—	—	—	—	—	—	—	—	Noon (28th).	N.E.	24	—
Falmouth -	3 a.m. (28th).	N.N.W.	6 a.m.	N.N.W.	46	8	6 p.m.	N.	15	9–11 a.m. (28th).	N. by E.	51	—
	8 a.m. (29th).	N.N.E.	10 a.m.	N.N.E.	41	3	8 p.m.	N.N.E.	12	11 a.m. (29th).	N.N.E.	44	
Stonyhurst -	—	—	—	—	—	—	—	—	—	Noon (28th).	N.N.E.	33	The wind occasionally reached the velocity of 30 miles an hour, but no gale was felt.
Kew - -	3 a.m. (29th).	N.N.E.	7 a.m.	N.E.	40	2	Noon.	N.E. by N.	9	7–9 a.m. (29th).	N.E.	40	—

March 30. The atmosphere gradually recovered its equilibrium as the barometer rose at the stations in the south of England and north of France. The wind, however, continued north-easterly, moderate to fresh in the south, but very light in the north until the end of the month.

REMARKS.

We may at this juncture take a general glance at the characteristics of the weather during the three months which we have just discussed, with especial reference to wind, temperature, and pressure.

Wind.—As the anemometrical data from the observatories are only in process of calculation, it is not possible to give an analysis of them, so as to show the mean motion of the air in direction and velocity at each station. A few remarks as to the high winds, reaching a velocity of 30 miles and upwards, which have been those most especially adverted to in the preceding pages, may be of interest. The number of hours during the entire period in which the wind attained the requisite velocity, irrespective of its direction, at the several stations, was as follows:—

—	January.	February.	March.	Total.	—	January.	February.	March.	Total.
Valencia - -	330	292	102	724	Sandwick - -	150	161	106	417
Armagh - -	58	43	1	102	Falmouth - -	156	210	187	553
Glasgow - -	61	92	39	192	Stonyhurst -	36	81	24	141
Aberdeen - -	65	42	33	140	Kew - - -	44	56	17	117

This statement is sufficient to show what an influence the local conditions of the station exert on the amount of wind registered at it. Allusion has already been made to this subject in the Introduction at page vii.

As regards the direction in which the air moved, there are some peculiarities which deserve notice. In January an extraordinary prevalence of strong winds from points between south and east is recorded at some of the stations. The number of hours during which the wind blew from that quarter during the month, with the velocity of or exceeding 30 miles an hour, was:—

Valencia, 234; Falmouth, 47; Stonyhurst, 20; Aberdeen, 54; Armagh, 27; Kew, 3; Glasgow, 20; Sandwick, 100.

These figures appear to indicate the existence of an area of low barometrical pressure off the south-west coast of Ireland, an idea which is confirmed by an examination of the monthly and five-day barometrical means in Tables I. and II.

During the first three weeks of the month of February the direction of the wind was generally south-westerly, and the vane did not shift its position much, except during the local gale of the 12th, when very sudden changes in direction were observable at Kew and Valencia.

The series of storms which set in at the end of February marked the commencement of altered conditions of atmospherical circulation, which continued through March.

The direction of the wind was northerly, from north-west to north-east, and the number of hours during which high velocities were registered at Falmouth was nearly twice as great as at Valencia; this was almost an exact reversal of the proportions which had obtained at these two stations during the month of January.

On the whole the first quarter of 1869 must be considered a very stormy period.

Pressure.—Table I., pp. 37–40, gives us the monthly means as well as the extreme readings for each of the observatories. These figures are reduced to 32° F., but not to sea level. If we apply this latter correction by means of Table A. (Introduction, p. ii.), we get the following comparative statement* for January:—

——	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.		Inches.		Inches.		Inches.
Valencia - -	29·735	—	30·354	8th, 11 p.m.	28·410	28th, 7 p.m.	1·944
Armagh - -	29·764	—·011	30·416	9th, 10 a.m.	28·437	28th, 11 p.m.	1·979
Glasgow - -	29·813	+·077	30·398	22nd, 10 a.m.	28·510	29th, 2 a.m.	1·888
Aberdeen - -	29·752	+·029	30·395	22nd, 10 a.m.	28·547	29th, 5 a.m.	1·848
Falmouth - -	29·950	—·022	30·518	8th, 8 p.m.	28·827	28th, 9 p.m.	1·691
Stonyhurst -	29·909	+·077	30·491	9th, 11 a.m.	28·712	29th, 2 a.m.	1·779
Kew - - -	30·032	+·094	30·571	9th, 11 a.m.	28·990	29th, 4 a.m.	1·581

The second column indicates the excess or defect of the mean of the month as compared with the most authentic mean pressures which have been hitherto determined.

The monthly means, from which this column has been deduced, are mostly taken from Mr. Buchan's paper on the mean monthly and annual pressure of the atmosphere in Scotland (Journal Scottish Meteorological Society, vol. ii., new series, p. 251). The mean for Helston is used for comparison with Falmouth, and that for Greenwich for comparison with Kew. The mean for Stonyhurst is that published by the College, but reduced to sea level.

The table shows a slight excess of pressure over the east and north of Great Britain, but an area of deficiency of this element embraces Ireland, and extends to Falmouth. It seems probable that if we had a trustworthy mean pressure for Valencia, the second column would show a defect in the average amount of pressure at that station.

The highest reading during the month was 30·571 at Kew at 11 a.m. on the 9th, and the lowest 28·410 at Valencia at 7 p.m. on the 28th, the instance to which allusion has already been made, p. 9.

The maximum readings were registered, at all except the two Scotch observatories, between 6 p.m. on the 8th and noon on the 9th. At Glasgow and Aberdeen the greatest pressure was experienced on the morning of the 22nd.

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* The time employed in the tables is astronomical time. In these statements and in the plates it is civil time (Greenwich).

The minimum readings were registered at all the observatories during the night of the 28th–29th.

The maximum range was noticed at Armagh.

February.

—	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.		Inches.		Inches.		Inches.
Valencia - -	29·919	—	30·488	13th, 10 a.m.	28·777	1st, 4 a.m.	1·711
Armagh - -	29·799	−·058	30·285	13th, 10 a.m.	28·716	1st, 7 a.m.	1·569
Glasgow - -	29·734	−·109	30·227	15th, 3 a.m.	28·651	1st, 7 a.m.	1·576
Aberdeen - -	29·652	−·203	30·199	15th, 3 a.m.	28·630	1st, 7 a.m.	1·569
Falmouth - -	30·062	+·026	30·580	13th, 6 p.m.	28·864	1st, 7 a.m.	1·726
Stonyhurst -	29·857	−·066	30·313	23rd, 9 p.m.	28·767	1st, 1 p.m.	1·546
Kew - -	30·004	−·004	30·461	13th, 6 p.m.	28·983	1st, 1 p.m.	1·478

This table shows a general deficiency of pressure excepting at Falmouth. The amount of this deficiency was greatest at Aberdeen. At Kew the pressure was nearly at its normal amount. The maximum range was recorded at Falmouth. The maximum reading was registered at Falmouth. The minimum readings at all the observatories were registered before 2 p.m. on the 1st.

March.

—	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.		Inches.		Inches.		Inches.
Valencia - -	29·994	—	30·443	23rd, 8 p.m.	29·194	16th, 6 p.m.	1·249
Armagh - -	29·917	+·146	30·484	23rd, 11 a.m.	29·102	17th, 4 a.m.	1·382
Glasgow - -	29·933	+·217	30·451	23rd, 9 a.m.	28·903	2nd, 4 a.m.	1·548
Aberdeen - -	29·896	+·158	30·400	23rd, 7 p.m.	28·776	2nd, 4 a.m.	1·624
Falmouth - -	29·892	+·003	30·358	6th, 8 p.m.	29·229	17th, 1 a.m.	1·129
Stonyhurst - -	29·884	+·019	30·405	23rd, 9 p.m.	29·040	2nd, 7 a.m.	1·365
Kew - - -	29·836	+·008	30·355	6th, 10 p.m.	29·171	2nd, 10 a.m.	1·184

March differs from the two preceding months in exhibiting an excess of pressure at all the stations which reached its greatest amount at Glasgow, and was least at Falmouth, where, as well as at Kew, the mean differed very slightly from its normal value.

The range was greatest at Aberdeen, and least at Falmouth. The highest reading was registered at Armagh on the 23rd, on which day the mercury reached its highest level at all the observatories except Falmouth and Kew. The minimum reading was registered at Aberdeen on the morning of the 2nd.

The conditions of mean pressure during the three months are in accordance with what might have been anticipated from the remarks on the wind. In January its general direction was southerly; in February, south-westerly to westerly winds were most common; while in March a considerable prevalence of northerly and north-east winds was noticed.

Temperature.—The following tables, for the dry bulb thermometer, are similar to those just given for the barometer.

January.

—	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
Valencia -	47°·7	° —	53°·7	4th, 4 a.m.	37°·0	22nd, 3 a.m.	16°·7
Armagh - -	43·9	—	53·1	16th, 2 p.m.	31·9	26th, 2 a.m.	21·2
Glasgow - -	42·0	+4·7	50·1	5th, 10 a.m.	29·5	26th, 7 a.m.	20·6
Aberdeen - -	41·1	+5·1	48·8	31st, 6 p.m.	30·6	26th, 8 a.m.	18·2
Falmouth - -	47·9	—	54·0	30th, noon.	36·0	24th, 9 a.m.	18·0
Stonyhurst - -	41·5	+4·2	51·8	31st, noon.	28·4	25th, 2 a.m.	23·4
Kew - - -	42·4	+6·2	55·3	30th, 6 p.m.	27·6	25th, 7 a.m.	27·7

The figures for the mean temperatures for London, Aberdeen, and Glasgow have been taken from Dove's Klimatologische Beiträge, Part II., p. 140; those from Stonyhurst from the observations printed by the College.

The month was an exceptionally warm one; in fact, there were only two days at Kew, the 23rd and 24th, and one at Falmouth, the 24th, when the average temperature was below 32°.

The maximum and minimum temperatures, and consequently the greatest range, were registered at Kew.

February.

—	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
Valencia - -	48°·8	° —	54°·6	4th, 3 a.m.	39°·1	2nd, 6 a.m.	15°·5
Armagh - -	45·1	—	55·2	5th, 5 p.m.	32·4	28th, 4 a.m.	22·8
Glasgow - -	42·6	+4·4	55·6	5th, 2 p.m.	29·0	28th, 11 a.m.	26·6
Aberdeen - -	41·0	+2·3	56·9	5th, noon	29·9	28th, 5 a.m.	27·0
Falmouth - -	48·5	—	59·8	5th, 3 p.m.	38·0	22nd, 7 a.m.	21·8
Stonyhurst - -	44·0	+5·6	56·3	5th, 2 p.m.	30·8	28th, 1 p.m.	25·5
Kew - - -	46·0	+7·7	59·6	5th, 2 p.m.	32·0	19th, 7 a.m.	27·6

February was also a warm month, the temperature being nearly 8° above the average at Kew.

The greatest range was noticed at Kew.

The maximum temperature was registered at Falmouth. A wave of heat passed over all the stations except Valencia, during the afternoon of the 5th.

The lowest temperature was registered at Glasgow.

March.

—	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°		°		
Valencia	44·6	—	53·4	27th, 4 p.m.	34·4	15th, 2 a.m.	19·0
Armagh	39·5	—	51·5	7th, 4 p.m.	29·0	12th, 7 a.m.	22·5
Glasgow	38·4	−1·0	51·1	23rd, 4 p.m.	27·4	31st, 7 a.m.	23·7
Aberdeen	37·8	−1·0	49·1	25th, 2 p.m.	26·0	2nd, midngt.	23·1
Falmouth	42·6	—	53·2	1st, noon	29·0	15th, 6 a.m.	24·2
Stonyhurst	37·7	+1·2	48·2	24th, 3 p.m.	27·9	13th, 6 a.m.	20·3
Kew	38·7	−2·4	53·0	5th, 3 p.m.	29·3	7th, 6 a.m.	23·7

In temperature, as in pressure, March differs from the two preceding months, and as we might expect, in the opposite direction; the mean temperature at three of the observatories being under its average amount.

The extreme readings observed fall below those of January and February.

The greatest range was observed at Falmouth.

The maximum reading is reported from Valencia.

The minimum reading is reported from Aberdeen.

A few observations on the five day means of temperature given in Table II., p. 41, may not be without interest. The only stations in these islands for which such means have been calculated by Dove* are—

London, 20 years (1797-1816.—Howard's observations).

Greenwich, 43 years.	Edinburgh, 40 years.
Oxford, 25 years.	Dublin, 22 years.

If we take the figures for Greenwich for comparison with those for Kew (Table II.), we get the following statement of the successive variations of temperature in the neighbourhood of London from its average height for each five days during the quarter.

	°		°		°
Jan. 1– 5	+ 8·6	Jan. 31–Feb. 4	+12·3	Mar. 2– 6	−0·2
„ 6–10	+10·2	Feb. 5– 9	+10·7	„ 7–11	−3·6
„ 11–15	+ 5·9	„ 10–14	+ 8·9	„ 12–16	−5·7
„ 16–20	+ 3·7	„ 15–19	+ 7·7	„ 17–21	−0·8
„ 21–25	− 3·8	„ 20–24	+ 0·9	„ 22–26	−1·6
„ 26–30	+ 7·7	„ 25–Mar. 1	+ 5·2	„ 27–31	−4·9

We see, therefore, that January and February were much too warm, with the exception of the five days from the 21st to the 25th January, when the temperature was low. The elevation of temperature during the first fortnight of February was very remarkable.

It is unfortunate that the absence of information from other parts of the country renders it impossible to institute a similar comparison for the other observatories.

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* Darstellung der Wärme-erscheinungen durch Fünftägige Mittel. Part II., Berlin, 1863.

Rain.—The observatories have not as yet been supplied with the self-recording rain gauges on Beckley's principle, which are described in the Annual Report of the office for 1869. Accordingly rain returns are not at present received from the observatories of Aberdeen or Falmouth.

The telegraphic reporting stations are on the coast; they are few in number, and many of them in exceptional situations, so that it does not appear that an analysis of the returns received from them would throw much light on the distribution of rain over the country.

It seems, therefore, scarcely advisable to enter on a discussion of this question at present, inasmuch as the precipitation of moisture is influenced by local circumstances in a much greater degree than any other of the meteorological elements, and the number of the existing stations in connexion with the office is far too limited to afford satisfactory information on the subject.

TABLE I.—MEAN MONTHLY RESULTS from the continuous RECORDS at the SEVEN BRITISH OBSERVATORIES, for the Year 1869.

VALENCIA.

—	Temperature.					Pressure.					Mean.	
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Vap.	Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January	47·7	4 16	53·7	21 15	37·0	29·709	8 11	30·329	28 7	**28·386**	·274	29·435
February	48·8	4 15	54·6	1 18	39·1	29·893	12 22	30·462	1 0	29·007	·277	29·616
March	44·6	24 4	53·4	14 14	34·4	29·968	23 8	30·418	16 6	29·169	·222	29·746
April	51·9	27 4	69·6	3 5	37·4	29·927	24 23	30·258	15 13	29·282	·305	29·622
May	51·4	24 4	63·4	11 16	40·1	29·755	29 10	30·317	6 15	28·961	·291	29·464
June	56·8	30 6	74·3	13 16	45·8	30·136	22 12	30·413	12 18	29·527	·361	29·775
July	61·4	16 3	77·9	26 17	50·7	30·011	13 21	30·410	25 4	29·553	·441	29·570
August	59·9	27 3	**82·3**	31 17	47·1	30·193	31 23	30·530	2 19	29·640	·411	29·782
September	57·2	4 2	68·4	11 17	45·6	29·647	1 9	30·529	12 14	29·064	·374	29·273
October	54·1	9 2	73·4	19 11	42·4	30·107	21 22	**30·580**	15 20	29·343	·344	29·763
November	50·1	18 1	57·4	10 19	35·7	29·997	19 10	30·561	22 1	29·281	·299	29·698
December	43·9	18 2	55·0	27 11	**27·7**	29·777	5 11	30·563	13 3	28·821	·230	29·547
Annual	52·3	—	—	—	—	29·927	—	—	—	—	·319	29·608

ARMAGH.

—	Temperature.					Pressure.					Mean.	
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Vap.	Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January	43·9	16 2	53·1	25 15	31·9	29·534	8 22	30·187	28 11	**28·242**	·246	29·288
February	45·1	5 5	55·2	27 16	32·4	29·573	12 22	30·059	1 0	28·548	·255	29·318
March	39·5	7 4	51·5	11 19	29·0	29·691	22 23	30·250	16 16	28·876	·208	29·488
April	48·5	11 3	69·1	2 12	32·1	29·735	28 13	30·275	15 16	28·780	·264	29·471
May	46·7	1 4	62·5	8 17	33·8	29·658	12 23	30·122	6 15	28·875	·245	29·413
June	54·5	25 1	71·0	13 15	36·5	29·998	27 9	30·163	14 12	29·144	·328	29·670
July	61·5	17 4	**78·1**	19 17	47·7	29·770	10 3	30·151	29 3	29·321	·407	29·363
August	57·7	27 4	77·4	29 18	38·3	29·956	31 23	30·327	8 20	29·371	·369	29·587
September	55·3	9 2	68·7	19 19	44·0	29·397	1 9	30·338	12 16	28·722	·359	29·038
October	50·3	9 2	69·0	16 19	34·9	29·841	21 23	30·337	15 21	28·903	·312	29·529
November	43·1	18 2	58·6	29 20	29·5	29·662	19 22	30·266	21 21	29·022	·237	29·425
December	37·4	18 4	55·2	27 18	**20·7**	29·510	5 13	**30·434**	13 5	28·305	·200	29·310
Annual	48·6	—	—	—	—	29·694	—	—	—	—	·286	29·408

The barometrical readings are reduced to 32°, but not to sea level. See headings to Table II.

Table I.—Mean Monthly Meteorological Results, &c.—*continued.*

GLASGOW.

—	TEMPERATURE.					PRESSURE.						
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Mean.	
											Vap.	Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January -	42·0	4 22	50·2	25 19	29·5	29·608	21 22	30·186	28 14	28·320	·227	29·381
February -	42·6	5 2	55·6	27 23	29·0	29·533	14 15	30·019	1 0	28·525	·227	29·306
March -	38·4	23 4	51·1	30 19	27·4	29·725	22 21	30·243	1 16	28·709	·173	29·552
April -	47·1	11 3	69·6	8 17	30·0	29·777	28 9	30·426	15 22	28·965	·242	29·535
May -	45·5	1 4	65·0	8 17	32·0	29·704	13 13	30·170	6 15	*28·948	·209	29·495
June -	54·2	25 4	71·5	9 16	38·8	29·832	27 18	30·150	14 16	29·133	·301	29·531
July -	59·4	17 3	**79·0**	27 16	44·7	29·773	10 10	30·190	29 7	29·356	·384	29·389
August -	56·1	28 2	76·1	29 17	35·0	29·921	31 23	30·307	9 0	29·322	·338	29·583
September	54·6	9 1	66·4	2 17	39·3	29·405	1 0	30·303	19 3	28·518	·345	29·060
October -	48·3	10 3	66·9	26 16	39·9	29·803	21 23	30·238	15 17	28·943	·269	29·534
November	40·6	18 6	55·9	24 12	24·1	29·573	19 23	30·179	21 18	28·976	·209	29·364
December	35·8	18 4	53·0	27 19	**13·0**	29·505	5 21	**30.480**	13 8	**28·146**	·175	29·330
Annual -	47·0	—	—	—	—	29·680	—	—	—	—	·258	29·422

ABERDEEN.

—	TEMPERATURE.					PRESSURE.						
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Mean.	
											Vap.	Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January -	41·1	31 6	48·8	25 20	30·3	29·664	21 22	30·295	28 17	28·456	·224	29·440
February -	41·0	5 0	56·9	28 18	28·0	29·556	14 15	30·097	1 0	28·611	·204	29·352
March -	37·8	25 2	49·1	2 12	26·0	29·796	23 7	30·300	1 16	28·682	·178	29·618
April -	46·1	12 4	66·9	8 17	30·0	29·817	28 1	**30·586**	2 17	28·888	·233	29·584
May -	44·3	1 1	57·0	4 16	30·5	29·791	13 12	30·290	6 16	29·095	·204	29·587
June -	52·0	25 2	67·3	15 15	40·3	29·944	27 19	30·290	12 22	29·370	·284	29·660
July -	58·5	21 0	74·0	28 17	47·0	29·848	10 17	30·258	5 18	29·393	·364	29·484
August -	55·4	25 2	**78·3**	29 14	39·2	29·963	31 21	30·381	9 3	29·340	·323	29·640
September	53·7	7 3	66·8	26 18	40·9	29·469	1 0	30·382	19 4	28·584	·328	29·141
October -	47·1	8 2	67·5	26 15	29·6	29·848	21 10	30·282	15 22	29·007	·272	29·576
November	40·0	2 1	58·8	29 12	24·4	29·575	20 5	30·208	3 16	29·003	·191	29·384
December	35·7	13 3	47·9	1 21	**20·0**	29·571	5 22	30·542	13 10	**28·166**	·178	29·393
Annual -	46·1	—	—	—	—	29·737	—	—	—	—	·249	29·488

The barometrical readings are reduced to 32°, but not to sea level. See headings to Table II.

Table I.—Mean Monthly Meteorological Results, &c.—*continued.*

FALMOUTH.

—	Temperature.					Pressure.						
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Mean. Vap.	Mean. Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January -	47·9	1 11	54·5	23 21	36·0	29·726	8 8	30·280	28 9	28·605	·282	29·444
February -	48·5	5 3	59·8	21 19	38·0	29·829	13 6	**30·342**	1 0	28·847	·291	29·538
March -	42·6	1 1	53·2	14 18	29·0	29·662	6 8	30·120	16 13	28·999	·209	29·453
April -	49·9	27 1	63·6	3 12	37·4	29·796	12 8	30·130	15 22	29·136	·296	29·500
May -	51·6	23 1	60·9	29 16	40·2	29·578	31 23	30·114	6 15	28·846	·315	29·263
June -	56·5	7 0	70·1	16 14	47·1	29·907	16 10	30·204	13 15	29·275	·355	29·552
July -	61·6	18 2	**78·4**	9 16	51·8	29·889	10 0	30·237	25 16	29·544	·438	29·451
August -	60·9	26 3	73·8	30 17	48·9	29·978	15 9	30·212	8 22	29·586	·414	29·564
September	58·0	7 1	68·2	11 18	50·5	29·592	1 12	30·219	11 11	**28·459**	·405	29·187
October -	52·8	9 1	64·8	28 7	40·1	29·893	21 23	30·339	16 3	29·215	·333	29·560
November	48·7	3 0	56·7	23 20	36·3	29·818	18 9	30·323	22 6	28·976	·291	29·527
December	42·6	16 6	55·2	26 11	**26·0**	29·583	5 10	30·270	16 6	28·979	·245	29·338
Annual -	51·8	—	—	—	—	29·771	—	—	—	—	·323	29·448

STONYHURST.

—	Temperature.					Pressure.						
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Mean. Vap.	Mean. Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January -	41·5	31 0	51·8	24 14	28·3	29·501	8 23	30·093	28 14	**28·341**	·226	29·275
February -	44·0	5 2	56·3	28 1	30·8	29·465	23 9	29·907	1 1	28·396	·240	29·225
March -	37·7	24 3	48·2	12 18	27·9	29·492	22 21	29·999	1 19	28·648	·172	29·320
April -	48·5	14 1	73·1	2 15	32·9	29·589	28 10	30·117	15 23	28·666	·254	29·335
May -	46·5	1 3	60·3	12 16	36·2	29·464	29 10	29·959	6 15	28·620	·237	29·227
June -	54·5	6 5	72·5	11 15	41·0	29·690	27 19	29·974	14 23	29·006	·325	29·365
July -	61·2	17 2	80·5	27 17	43·8	29·658	10 10	30·045	5 14	29·306	·399	29·259
August -	57·7	28 3	**83·2**	30 18	36·8	29·765	31 22	30·082	8 22	29·145	·372	29·393
September	55·9	5 2	68·8	21 17	44·3	29·296	1 9	30·087	11 17	28·604	·363	28·933
October -	49·0	9 2	71·0	19 19	30·0	29·667	21 23	30·089	15 22	28·863	·280	29·387
November	42·2	15 17	53·0	30 10	27·4	29·462	20 4	29·986	5 12	28·772	·225	29·237
December	36·7	18 6	54·6	27 21	**14·3***	29·349	5 23	**30·250**	13 7	28·430	·187	29·162
Annual -	47·9	—	—	—	—	29·533	—	—	—	—	·273	29·260

* Doubtful.

The barometrical readings are reduced to 32°, but not to sea level. See headings to Table II.

Table I.—Mean Monthly Meteorological Results, &c.—*continued.*

KEW.

—	TEMPERATURE.					PRESSURE.						
	Mean. Fahr.	Date.	Max.	Date.	Min.	Mean.	Date.	Max.	Date.	Min.	Mean.	
											Vap.	Dry Air.
	°	D. H.	°	D. H.	°	In.	D. H.	In.	D. H.	In.	In.	In.
January -	42·4	31 6	55·5	24 17	27·6	29·993	8 22	30·537	28 16	28·952	·234	29·759
February -	46·0	5 2	59·6	18 19	32·0	29·967	13 6	30·422	1 1	28·946	·253	29·714
March -	38·7	5 3	53·0	6 18	29·3	29·797	6 10	30·316	1 22	29·133	·180	29·617
April -	51·0	14 3	74·5	1 17	29·5	29·980	28 18	30·339	16 6	29·118	·275	29·705
May -	51·5	26 4	68·7	29 17	35·3	29·796	31 20	30·275	6 16	29·104	·289	29·507
June -	56·4	7 3	82·0	16 14	40·6	30·057	16 14	30·314	13 18	29·353	·330	29·727
July -	64·6	22 14	**88·3**	28 16	48·7	30·062	9 22	30·397	26 5	29·754	·418	29·644
August -	60·6	28 2	86·6	31 17	40·5	30·124	31 21	30·408	9 4	29·542	·376	29·748
September	59·1	5 2	77·2	2 13	42·6	29·774	1 9	30·404	11 17	**28·715**	·480	29·294
October	49·4	10 3	73·0	27 18	29·6	30·033	21 21	30·497	16 7	29·247	·285	29·748
November	43·6	15 3	58·7	11 19	25·7	29·989	17 22	30·531	22 22	29·174	·232	29·757
December	38·8	16 10	55·4	28 15	**20·3**	29·765	5 11	**30·560**	16 9	28·916	·199	29·566
Annual	50·2	—	—	—	—	29·945	—	—	—	—	·296	29·649

The barometrical readings are reduced to 32°, but not to sea level. See headings to Table II.

TABLE II.—PART 1.

FIVE DAY MEANS of the DRY and WET THERMOMETERS and BAROMETER, from the continuous Records at the Seven BRITISH OBSERVATORIES, January to June 1869.

Five Day Periods.	THERMOMETER. Valencia. 12 ft. Dry.	Valencia. Wet.	Armagh. 4 ft. Dry.	Armagh. Wet.	Glasgow. 7 ft. Dry.	Glasgow. Wet.	Aberdeen. 41 ft. Dry.	Aberdeen. Wet.	Falmouth. 11 ft. Dry.	Falmouth. Wet.	Stonyhurst. 7 ft. Dry.	Stonyhurst. Wet.	Kew. 10 ft. Dry.	Kew. Wet.	BAROMETER. Valencia. 23 ft.	Armagh. 207 ft.	Glasgow. 184 ft.	Aberdeen. 88 ft.	Falmouth. 211 ft.	Stonyhurst. 361 ft.	Kew. 34 ft.	Five Day Periods.
Jan. 1–5	46·3	43·0	40·9	39·3	40·3	38·7	39·3	37·5	47·0	44·7	41·3	39·7	44·9	42·9	29·606	29·325	29·317	29·391	29·717	29·313	29·879	Jan. 1–5
„ 6–10	49·2	47·8	45·2	43·7	44·8	43·0	42·9	41·2	49·9	48·9	42·7	41·4	45·9	44·8	30·123	29·990	30·017	30·053	30·100	29·920	30·358	„ 6–10
„ 11–15	49·3	47·2	46·1	44·4	42·6	40·6	42·4	41·0	48·0	46·2	40·5	39·2	41·7	40·3	29·659	29·550	29·669	29·806	29·673	29·521	29·961	„ 11–15
„ 16–20	49·5	47·8	46·7	45·6	44·9	43·7	42·8	42·0	48·7	47·0	43·7	42·4	40·2	39·8	30·078	29·887	29·930	30·026	30·059	29·838	30·326	„ 16–20
„ 21–25	43·9	41·9	39·4	37·9	35·8	34·8	36·9	35·7	43·4	40·6	35·7	34·4	33·6	32·0	29·980	29·824	29·875	29·946	29·844	29·705	30·149	„ 21–25
„ 26–30	48·1	45·1	44·5	42·2	42·5	40·3	41·6	39·4	48·7	46·7	43·6	41·6	45·8	43·5	28·983	28·831	28·915	28·967	29·133	28·864	29·429	„ 26–30
Feb. 31–4	49·6	47·7	47·4	45·4	43·6	41·6	42·5	42·4	50·9	49·2	45·8	44·0	49·6	47·4	29·465	29·212	29·240	29·314	29·487	29·153	29·696	Feb. 31–4
„ 5–9	51·3	49·1	48·6	46·9	46·5	44·6	45·2	41·8	51·3	49·3	49·2	46·7	49·8	47·6	29·626	29·316	29·288	29·309	29·729	29·285	29·899	„ 5–9
„ 10–14	48·1	45·3	44·4	42·5	41·6	39·3	39·6	36·3	48·5	46·7	43·5	41·8	47·0	44·8	30·146	29·797	29·715	29·685	30·019	29·646	30·113	„ 10–14
„ 15–19	47·5	44·7	44·6	42·4	43·8	41·7	42·3	40·0	47·2	44·8	44·3	42·2	45·8	43·6	29·756	29·493	29·495	29·559	29·734	29·428	29·943	„ 15–19
„ 20–24	47·4	44·6	43·7	42·2	42·4	40·7	40·7	39·0	45·3	43·4	40·5	38·3	39·8	37·7	30·082	29·795	29·795	29·872	29·884	29·664	30·056	„ 20–24
Mar. 25–1	48·6	45·6	40·9	39·5	37·2	35·3	35·6	32·6	48·6	46·8	40·6	38·2	44·8	41·4	30·014	29·515	29·355	29·305	29·829	29·314	29·831	Mar. 25–1
„ 2–6	47·7	45·3	40·3	38·5	38·1	34·9	35·8	33·5	45·6	43·0	38·1	35·5	39·5	36·1	30·177	29·899	29·840	29·862	29·936	29·661	30·023	„ 2–6
„ 7–11	42·1	39·3	37·6	36·0	36·8	34·1	36·0	34·0	40·4	37·8	36·5	34·1	36·5	34·4	29·811	29·555	29·548	29·633	29·467	29·312	29·632	„ 7–11
„ 12–16	41·7	39·2	37·2	36·6	34·9	32·4	35·8	33·0	40·4	37·5	33·7	31·2	36·0	32·9	29·555	29·479	29·610	29·739	29·421	29·368	29·683	„ 12–16
„ 17–21	46·1	42·4	40·7	38·4	40·3	37·2	39·7	37·4	44·8	42·1	39·6	36·8	40·9	39·0	30·013	29·689	29·651	29·698	29·644	29·428	29·712	„ 17–21
„ 22–26	45·3	42·0	41·4	39·0	41·2	38·2	40·7	38·1	42·3	39·1	40·1	37·3	40·0	37·3	30·270	30·185	29·995	30·042	29·926	29·763	30·059	„ 22–26
„ 27–31	43·7	39·6	40·0	36·6	39·6	36·0	39·7	36·9	40·8	37·5	38·0	34·7	38·7	36·1	30·052	29·868	29·860	29·955	29·627	29·542	29·754	„ 27–31
Apr. 1–5	46·6	43·5	42·5	40·5	41·8	39·4	42·3	38·7	44·6	42·3	41·7	39·1	43·0	39·6	29·859	29·497	29·408	29·369	29·673	29·329	29·794	Apr. 1–5
„ 6–10	52·4	50·6	46·1	43·4	42·6	39·3	42·4	38·8	50·4	49·2	46·4	44·3	50·8	48·9	29·854	29·749	29·791	29·863	29·808	29·619	30·030	„ 6–10
„ 11–15	51·7	49·9	53·5	50·0	52·6	49·8	52·1	48·7	50·9	49·4	55·8	52·0	58·0	53·3	29·824	29·612	29·811	29·687	29·779	29·531	29·973	„ 11–15
„ 16–20	50·0	47·1	47·2	44·3	46·0	42·7	44·3	42·2	48·5	46·2	46·0	43·2	47·9	44·9	29·891	29·586	29·574	29·641	29·681	29·375	29·763	„ 16–20
„ 21–25	51·8	49·7	50·5	47·7	49·6	46·1	50·6	46·3	51·4	49·0	50·3	46·6	53·5	49·7	30·020	29·838	29·874	29·943	29·933	29·729	30·109	„ 21–25
„ 26–30	59·0	51·8	51·4	46·2	49·9	44·7	45·9	42·4	53·6	49·2	50·2	44·5	52·5	45·6	30·112	30·126	30·217	30·360	29·900	29·951	30·200	„ 26–30
May 1–5	53·4	51·4	46·3	43·8	44·7	40·1	42·5	38·2	51·1	50·0	44·6	41·1	48·6	45·9	29·707	29·674	29·800	29·954	29·611	29·549	29·872	May 1–5
„ 6–10	48·8	45·5	43·5	41·4	42·2	39·1	42·3	39·2	53·2	51·8	45·7	43·5	54·8	52·3	29·442	29·289	29·342	29·461	29·183	29·056	29·417	„ 6–10
„ 11–15	51·1	46·3	46·8	41·9	46·3	41·3	45·1	41·1	50·7	46·8	46·5	41·8	51·1	45·8	29·981	29·883	29·938	30·054	29·745	29·718	30·003	„ 11–15
„ 16–20	50·6	47·2	46·3	44·0	46·1	42·0	45·0	41·5	51·1	48·4	46·5	44·1	51·0	48·0	29·630	29·414	29·432	29·523	29·441	29·200	29·602	„ 16–20
„ 21–25	53·2	50·2	49·4	45·8	47·5	43·9	45·6	41·9	52·2	49·8	48·5	45·2	54·3	50·2	29·803	29·705	29·757	29·891	29·647	29·537	29·867	„ 21–25
„ 26–30	50·6	46·6	47·3	43·5	46·0	41·5	45·0	40·6	50·5	47·5	47·0	43·0	49·8	46·3	30·065	29·909	29·910	30·008	29·738	29·652	29·933	„ 26–30
June 31–4	55·1	52·8	53·5	50·2	51·0	47·0	50·4	45·5	55·0	52·7	52·5	49·0	55·3	51·4	30·077	29·819	29·781	29·840	29·947	29·668	30·088	June 31–4
„ 5–9	58·5	55·4	55·5	51·7	53·7	50·0	53·9	49·3	57·9	54·7	57·0	53·2	62·4	56·9	30·190	29·989	29·939	29·973	29·993	29·787	30·156	„ 5–9
„ 10–14	53·8	49·2	49·3	45·9	50·4	46·2	48·2	44·7	55·0	50·9	50·9	47·3	55·1	50·2	29·844	29·576	29·527	29·631	29·625	29·379	29·783	„ 10–14
„ 15–19	54·2	51·3	52·0	49·2	50·3	45·9	47·7	44·1	54·1	51·0	49·3	46·2	51·2	47·5	30·225	29·912	29·878	29·963	29·938	29·654	30·031	„ 15–19
„ 20–24	56·4	53·4	57·0	54·1	58·0	53·3	54·9	51·0	56·5	52·8	55·6	52·9	55·3	52·0	30·249	30·006	29·953	30·041	29·971	29·772	30·125	„ 20–24
„ 25–29	61·1	57·4	58·1	53·6	59·7	54·1	54·8	50·5	59·8	55·5	59·7	54·7	57·9	52·3	30·235	30·075	30·064	30·187	29·998	29·869	30·195	„ 25–29

Note.—The heights in the headings of the temperature columns are those of the thermometer bulbs above the ground. Those in the headings of the pressure columns are those of the barometer cisterns above mean sea level.

TABLE II.—Part 2.

Five Day Means of the Dry and Wet Thermometers and Barometer, from the continuous Records at the Seven British Observatories, July to December 1869.

Five Day Periods.	Thermometer.														Barometer.							Five Day Periods.
	Valencia. 12 ft.		Armagh. 4 ft.		Glasgow. 7 ft.		Aberdeen. 41 ft.		Falmouth. 11 ft.		Stonyhurst. 7 ft.		Kew. 10 ft.		Valencia. 23 ft.	Armagh. 207 ft.	Glasgow. 184 ft.	Aberdeen. 88 ft.	Falmouth. 211 ft.	Stonyhurst. 361 ft.	Kew. 34 ft.	
	Dry.	Wet	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.								
June 30–4	62·8	58·8	61·0	55·9	60·9	55·5	56·0	50·8	58·0	54·8	61·0	56·3	58·7	53·9	30·080	29·911	29·931	30·077	29·932	29·769	30·133	June 30–4
July 5–9	60·8	58·1	62·7	58·0	58·2	54·7	58·7	52·8	60·7	58·5	60·7	56·9	64·0	59·0	29·923	29·567	29·636	29·676	29·911	29·592	30·079	July 5–9
,, 10–14	59·6	56·4	61·1	55·7	58·3	53·4	58·3	52·3	61·5	56·7	59·0	54·5	65·4	57·8	30·309	30·037	29·988	30·018	30·075	29·868	30·228	,, 10–14
,, 15–19	64·7	61·3	63·5	59·2	61·3	57·1	58·7	54·9	64·1	60·8	64·2	59·7	69·3	63·1	30·128	29·942	29·925	30·009	29·919	29·752	30·094	,, 15–19
,, 20–24	62·3	59·6	63·2	58·8	61·9	57·9	61·7	56·8	62·4	58·9	63·6	58·2	65·8	59·0	29·911	29·701	29·723	29·797	29·834	29·611	30·005	,, 20–24
,, 25–29	59·2	55·8	58·2	54·7	57·0	53·4	57·1	53·5	61·5	57·6	58·3	54·3	62·3	57·1	29·810	29·564	29·579	29·678	29·724	29·467	29·888	,, 25–29
Aug. 30–3	59·2	56·5	56·0	53·4	55·2	52·1	56·1	51·5	61·3	58·5	57·7	55·0	62·0	57·9	29·868	29·565	29·543	29·616	29·759	29·432	29·907	Aug. 30–3
,, 4–8	59·4	57·5	56·7	53·8	55·5	51·8	53·3	49·9	60·4	56·5	56·8	53·9	60·6	56·5	30·165	29·862	29·809	29·876	29·957	29·663	30·066	,, 4–8
,, 9–13	58·1	54·9	55·0	52·1	54·4	49·7	51·8	48·3	59·5	54·8	54·4	50·5	58·3	53·2	30·086	29·747	29·642	29·674	29·833	29·478	29·873	,, 9–13
,, 14–18	59·3	56·2	58·2	54·9	55·5	52·2	57·3	52·8	60·2	56·6	57·5	53·9	59·5	55·0	30·383	30·167	30·137	30·220	30·160	29·956	30·302	,, 14–18
,, 19–23	61·1	57·5	61·3	57·5	59·5	55·3	58·1	53·9	68·0	57·5	59·0	55·8	60·0	55·8	30·296	30·074	30·061	30·127	30·097	29·908	30·280	,, 19–23
,, 24–28	65·6	61·1	63·8	59·5	61·1	57·3	60·1	55·2	66·2	61·6	67·0	60·7	68·9	62·2	30·154	30·005	30·024	30·093	29·958	29·833	30·193	,, 24–28
Sept. 29–2	55·0	50·4	52·1	47·9	50·8	45·6	51·9	47·0	57·3	53·2	51·4	47·4	53·9	48·1	30·354	30·210	30·194	30·269	30·076	29·983	30·280	Sept. 29–2
,, 3–7	60·1	57·2	58·5	55·2	57·5	54·2	57·0	53·7	60·6	58·2	59·4	55·4	62·3	62·3	29·638	29·477	29·523	29·631	29·580	29·399	29·835	,, 3–7
,, 8–12	56·8	53·2	55·3	52·0	56·8	52·9	54·8	52·1	58·0	55·4	55·8	52·9	60·5	60·6	29·342	29·115	29·184	29·243	29·291	29·023	29·493	,, 8–12
,, 13–17	58·0	55·3	55·3	52·6	53·7	51·2	52·3	50·0	59·0	56·8	55·3	53·0	59·5	59·5	29·531	29·218	29·175	29·270	29·562	29·132	29·685	,, 13–17
,, 18–22	55·7	52·0	51·6	49·1	51·3	48·3	50·8	46·9	55·5	52·6	52·6	49·6	55·2	55·1	29·749	29·373	29·238	29·253	29·634	29·219	29·737	,, 18–22
,, 23–27	57·2	54·5	56·0	53·9	54·3	52·0	53·3	49·7	57·5	55·9	55·6	53·4	59·2	59·3	29·865	29·570	29·526	29·556	29·849	29·486	29·997	,, 23–27
Oct. 28–2	55·0	52·5	55·5	54·2	54·9	53·6	53·6	52·6	57·6	55·9	57·6	55·2	59·4	58·4	29·470	29·366	29·477	29·672	29·362	29·282	29·669	Oct. 28–2
,, 3–7	59·0	56·6	57·0	54·8	54·6	52·6	52·7	51·1	57·6	55·8	55·0	52·5	54·3	52·3	29·954	29·866	29·931	30·035	29·900	29·768	30·158	,, 3–7
,, 8–12	60·5	58·4	60·0	57·5	57·3	55·4	57·0	54·0	58·7	57·6	59·6	57·8	59·2	57·3	30·006	29·824	29·836	29·881	29·946	29·729	30·157	,, 8–12
,, 13–17	50·9	47·5	45·8	43·9	43·6	41·2	40·8	38·7	51·4	49·4	45·4	43·1	48·9	45·4	29·909	29·510	29·423	29·466	29·711	29·411	29·788	,, 13–17
,, 18–22	50·4	47·4	46·1	44·1	45·0	42·4	44·2	43·9	49·5	46·5	43·7	41·4	43·7	41·0	30·309	29·983	29·901	29·933	29·977	29·694	30·056	,, 18–22
,, 23–27	50·9	47·5	43·4	41·4	40·7	39·0	39·6	37·5	48·7	44·8	41·4	38·3	42·5	39·4	30·307	29·966	29·861	29·827	29·982	29·748	30·029	,, 23–27
Nov. 28–1	52·2	50·3	48·0	46·4	46·7	44·4	45·6	43·0	48·9	46·4	46·1	43·7	45·0	42·5	30·409	30·070	29·959	29·967	30·084	29·764	30·211	Nov. 28–1
,, 2–6	52·5	50·0	45·4	43·5	41·7	39·3	40·1	37·6	52·1	49·7	44·5	41·9	48·2	44·2	29·947	29·510	29·372	29·359	29·714	29·248	29·947	,, 2–6
,, 7–11	47·5	45·0	39·3	37·6	37·5	35·4	36·3	33·9	47·0	44·2	39·2	36·7	39·9	37·4	30·112	29·805	29·694	29·693	29·916	29·563	30·104	,, 7–11
,, 12–16	53·5	51·2	49·0	47·3	47·6	45·5	46·1	43·1	51·9	49·9	47·9	46·4	50·2	47·8	29·951	29·622	29·558	29·556	29·942	29·533	29·951	,, 12–16
,, 17–21	51·5	48·8	46·8	44·4	45·1	42·8	44·7	41·7	47·7	45·3	43·5	41·2	39·9	38·5	30·224	29·891	29·812	29·808	30·089	29·755	30·234	,, 17–21
,, 22–26	46·6	44·4	39·3	37·9	35·1	34·3	37·3	35·0	44·5	42·9	39·7	38·4	41·8	40·3	29·733	29·428	29·368	29·390	29·488	29·212	29·725	,, 22–26
Dec. 27–1	47·2	44·7	35·6	33·6	31·9	29·7	31·1	29·2	46·2	43·9	33·8	32·0	37·5	35·9	29·927	29·686	29·630	29·668	29·700	29·438	29·890	Dec. 27–1
,, 2–6	40·4	38·1	34·4	33·6	31·6	30·4	32·9	32·0	40·0	37·5	35·2	33·8	34·9	33·3	30·224	30·103	30·172	30·283	29·923	29·910	30·190	,, 2–6
,, 7–11	46·2	44·1	40·7	39·4	39·0	38·3	39·4	37·6	46·2	44·8	38·5	37·5	41·4	40·7	29·689	29·501	29·530	29·621	29·534	29·391	29·803	,, 7–11
,, 12–16	47·6	43·7	40·0	38·6	39·8	38·0	38·3	36·0	47·7	45·0	40·8	39·0	44·5	42·0	29·370	28·973	28·756	28·891	29·367	28·876	29·468	,, 12–16
,, 17–21	45·7	43·2	39·4	38·5	36·8	35·6	36·7	34·8	45·5	43·3	39·8	38·5	43·6	41·8	29·487	29·169	29·124	29·161	29·383	29·023	29·509	,, 17–21
,, 22–26	38·6	36·6	32·7	31·3	34·2	30·1	33·5	32·2	36·5	35·6	33·8	32·0	34·5	32·9	30·103	29·894	29·884	29·968	29·655	29·520	29·757	,, 22–26
,, 27–31	44·1	42·8	37·8	36·7	35·9	34·8	34·9	33·4	40·9	45·2*	33·6	33·2	35·2	33·5	29·457	29·348	29·377	29·415	29·562	29·296	29·804	,, 27–31

* Mean of two days only.

Note.—The heights in the headings of the temperature columns are those of the thermometer bulbs above the ground. Those in the headings of the pressure columns are those of the barometer cisterns above mean sea level.

TABLE B.

Factors for Calculation of Barometrical Gradients.

	Christiansd.	Skdsns.	Oxö.	Thrso.	Wick.	Nairn.	Abrdn.	Leith.	Glsgw.	Ardrsn.	Grncle.	Armgh.	Vlncia.	C.Clear.	Roche's Point.	Stnyht.	Livrpl.	Hlyhd.	Pmbke.	Penzce.
Christiansund																				
Skudesnaes	1/5																			
Oxö	1/6	5/11																		
Thurso	1/9	2/11	1/7																	
Wick	1/8	1/5	1/7	3/1																
Nairn	1/10	1/6	1/8	5/6	7/8															
Aberdeen	1/9	2/11	1/7	1/2	5/9	7/9														
Leith	1/11	1/7	1/8	1/3	1/3	1/2	5/8													
Glasgow	1/11	1/7	1/9	2/7	3/8	1/2	10/11	5/4												
Ardrossan	1/12	1/8	1/9	2/7	1/3	2/5	2/5	5/6	2/1											
Greencastle	1/13	1/9	1/10	2/9	2/9	2/7	1/4	1/3	1/2	2/3										
Armagh	1/14	1/10	1/11	2/11	2/11	2/9	2/9	1/3	2/5	1/2	1/1									
Valencia	1/18	1/14	1/15	1/9	1/9	1/8	1/9	1/7	1/7	1/6	2/9	1/4								
Cape Clear	1/18	1/14	1/15	1/10	1/10	1/8	1/9	1/7	1/7	1/6	1/5	1/4	8/7							
Roche's Point	1/17	1/13	1/14	1/9	1/9	1/8	1/8	1/6	2/11	1/5	1/4	2/7	5/8	1/1						
Stonyhurst	1/13	1/8	1/9	2/9	2/11	2/9	1/4	2/5	2/5	2/5	2/7	1/3	1/6	1/6	1/5					
Liverpool	1/14	1/9	1/9	1/6	1/6	1/5	1/4	1/3	1/3	1/3	2/7	1/3	2/11	2/11	2/9	5/3				
Holyhead	1/14	1/10	1/10	1/6	1/6	1/5	1/5	2/7	1/3	1/3	1/3	1/2	2/9	1/4	1/3	4/7	5/6			
Pembroke	1/16	1/11	1/12	1/8	1/8	1/7	1/7	2/11	1/5	1/5	2/9	2/7	1/4	2/7	2/5	1/3	2/5	1/2		
Penzance	1/18	1/13	1/14	1/10	1/10	1/9	1/9	1/7	1/7	1/7	1/6	1/5	2/9	2/7	1/3	1/5	2/9	1/4	1/2	
Falmouth	1/18	1/13	1/13	1/10	1/10	1/9	1/9	1/7	1/7	1/7	1/6	1/5	2/9	2/7	1/3	1/5	1/4	1/4	5/9	5/2
Plymouth	1/17	1/12	1/13	1/10	1/10	1/9	1/8	1/7	1/7	1/6	1/6	1/5	1/5	2/9	2/7	2/9	1/4	2/7	5/8	8/9
Portsmouth	1/16	1/11	1/11	1/10	1/9	1/8	1/8	1/6	1/6	1/6	1/7	1/6	1/7	1/6	2/11	1/4	2/7	1/4	1/3	2/7
London	1/15	1/10	1/10	1/9	1/9	1/8	1/7	1/6	1/6	1/6	1/7	1/6	1/8	1/7	1/6	3/10	1/3	1/4	2/7	2/9
Yarmouth	1/13	1/8	1/8	1/8	1/8	1/7	1/6	2/11	2/11	1/6	1/7	1/6	1/9	1/8	1/7	3/10	2/7	3/7	1/5	1/6
Scarborough	1/12	1/7	1/7	2/11	2/11	2/9	2/7	1/3	2/7	2/7	2/9	2/9	1/8	1/7	1/6	2/3	1/2	1/3	2/9	1/6
Shields	1/11	1/7	1/7	2/9	1/4	2/7	2/5	2/3	1/2	2/5	1/4	2/7	1/7	1/7	1/6	2/3	5/11	1/3	2/9	1/7
Helder	1/12	1/7	1/7	1/9	1/8	1/8	1/7	1/7	1/7	1/8	1/9	1/8	1/11	1/11	1/10	1/5	2/11	1/7	1/7	1/8
Brussels	1/15	1/10	1/9	1/11	1/10	1/10	1/9	1/8	1/8	1/9	1/10	1/9	1/11	1/11	1/10	1/6	1/6	1/7	1/7	1/8
Cape Gris Nez	1/15	1/10	1/10	1/10	1/10	1/8	1/8	1/7	1/7	1/8	1/8	1/7	1/9	1/8	1/8	1/5	2/9	2/11	1/5	2/11
Jersey	1/18	1/13	1/13	1/11	1/11	1/10	1/10	1/8	1/8	1/8	1/8	1/7	1/7	1/6	1/6	2/11	1/5	1/5	1/4	1/3
Brest	1/20	1/15	1/15	1/12	1/12	1/11	1/11	1/9	1/9	1/9	1/8	1/7	1/6	1/5	1/5	1/7	1/6	1/6	1/4	3/7
L'Orient	1/20	1/15	1/15	1/13	1/13	1/12	1/11	1/10	1/10	1/9	1/9	1/8	1/7	1/7	1/6	1/7	1/7	1/7	1/5	3/11
Rochefort	1/22	1/17	1/16	1/15	1/15	1/14	1/13	1/12	1/12	1/12	1/12	1/11	1/10	1/10	1/9	1/10	1/9	1/9	1/7	1/6
Biarritz	1/26	1/20	1/19	1/18	1/18	1/17	1/16	1/15	1/15	1/15	1/15	1/14	1/12	1/12	1/11	1/12	1/12	1/12	1/10	1/9
Corunna	1/31	1/22	1/22	1/19	1/19	1/17	1/17	1/16	1/15	1/15	1/14	1/13	1/10	1/10	1/10	1/13	1/13	1/12	1/10	1/8
Paris	1/18	1/13	1/12	1/12	1/12	1/11	1/10	1/9	1/10	1/10	1/10	1/9	1/10	1/10	1/9	1/7	1/7	1/8	1/7	1/6
Strasbourg	1/17	1/13	1/11	1/14	1/14	1/14	1/12	1/12	1/12	1/14	1/13	1/13	1/15	1/14	1/13	1/10	1/10	1/11	1/10	1/11
Lyons	1/21	1/16	1/15	1/17	1/16	1/16	1/15	1/14	1/14	1/14	1/14	1/14	1/14	1/12	1/13	1/11	1/11	1/12	1/10	1/10
Toulon	1/24	1/19	1/18	1/20	1/20	1/19	1/18	1/17	1/17	1/17	1/18	1/17	1/17	1/16	1/16	1/14	1/14	1/15	1/14	1/13
	Christiansund	Skudesnaes	Oxö	Thurso	Wick	Nairn	Aberdeen	Leith	Glasgow	Ardrossan	Greencastle	Armagh	Valencia	Cape Clear	Roche's Point	Stonyhurst	Liverpool	Holyhead	Pembroke	Penzance

	Falmth.	Plymth.	Ptsmth.	London.	Yrmth.	Scarbh.	Shields.	Helder.	Brssls.	C. Gris Nez.	Jersey.	Brest.	L'Ornt.	Rchfrt.	Birrtz.	Cornna.	Paris.	Strsbrg.	Lyons.	Toulon.
Plymouth	5/4																			
Portsmouth	1/3	5/12																		
London	1/4	2/7	6/7																	
Yarmouth	1/6	1/5	1/3	1/2																
Scarborough	1/6	2/11	1/4	1/3	2/5															
Shields	1/6	1/6	1/5	2/9	2/7	5/6														
Helder	1/8	1/7	1/5	1/4	5/11	1/4	1/5													
Brussels	1/7	1/7	1/4	1/3	1/3	1/5	1/6	2/5												
Cape Gris Nez	1/5	1/4	1/2	5/8	5/11	2/9	2/11	2/7	1/2											
Jersey	2/5	1/2	1/2	1/3	1/5	1/6	1/7	1/7	1/3	1/3										
Brest	5/11	5/12	1/4	1/5	1/7	1/8	1/8	1/9	1/8	2/11	1/2									
L'Orient	1/3	1/3	1/4	1/5	1/7	1/8	1/9	1/9	1/7	1/5	1/2	1/1								
Rochefort	1/6	1/6	1/6	1/7	1/8	1/10	1/11	1/10	1/7	1/6	1/4	1/4	1/6							
Biarritz	1/8	1/9	1/9	1/10	1/11	1/13	1/14	1/12	1/10	1/9	1/7	1/6	1/5	1/3						
Corunna	1/9	1/9	1/11	1/12	1/14	1/14	1/15	1/16	1/14	1/12	1/9	1/7	1/7	1/7	1/6					
Paris	1/6	1/5	1/4	1/4	2/9	1/7	1/8	1/5	1/3	2/5	2/7	2/11	1/5	2/9	1/7	1/11				
Strasbourg	1/10	1/9	1/7	1/7	1/7	1/9	1/10	1/6	1/4	2/11	1/8	1/10	1/9	1/8	1/10	1/15	1/4			
Lyons	1/10	1/9	1/8	1/8	1/9	1/11	1/12	1/9	1/6	1/7	1/7	1/8	1/7	1/5	1/6	1/11	1/4	1/4		
Toulon	1/12	1/12	1/11	1/11	1/12	1/14	1/15	1/12	1/9	1/10	1/10	1/11	1/10	1/7	1/6	1/13	1/7	1/7	1/3	
	Falmouth	Plymouth	Portsmouth	London	Yarmouth	Scarborough	Shields	Helder	Brussels	Cape Gris Nez	Jersey	Brest	L'Orient	Rochefort	Biarritz	Corunna	Paris	Strasbourg	Lyons	Toulon

Explanation of the Table. (See Introduction, p. viii.)

In order to convert barometrical differences between any two stations into gradients, it is necessary to multiply them by factors depending on the distance between the stations. These factors are obtained by expressing the ratio between the unit of distance (50 geographical miles), and the actual distance between the stations, as a simple fraction.

Thus the distance from Aberdeen to Rochefort is 673 miles $\frac{50}{673} = \frac{1}{13 \cdot 4}$. The factor assumed for this distance is $\frac{1}{13}$.

The mode of using the table is as follows:—On the 1st of February 1868, the reading at Rochefort at 8 a.m. was 30·16 in.; that at Aberdeen was 28·40 in. The difference between these two reports amounts to 1·76 in. The factor for the distance being $\frac{1}{13}$, we find 13·5 hundredths of an inch per 50 geographical miles to be the required gradient.

If the difference be given in French measures (5 millimetres per 100 geographical miles), we get the same result. In this case the difference is 44·8 millimetres, and $\frac{44 \cdot 8}{13} \times \frac{2}{5} = 13 \cdot 5$.

PART 2.

April 1. Light north-easterly winds were prevalent in the morning, except on the west coast of Scotland, where faint south-westerly airs had begun to make their appearance. The weather was fine, but the barometer fell steadily during the day, especially at the northern stations (Plate XXXVII.), and by 8 a.m. on the 2nd the decrease had exceeded 0·6 in. in the north of Scotland. The gradients, however, were not very steep, that from Penzance to Nairn being only 5·8, so that the wind, while affected in its general direction by the distribution of pressure, was for the most part moderate in force, only reaching the velocity of a strong breeze at Valencia for a few hours in the afternoon. In Norway, however, a fresh S.S.W. wind was blowing at Skudesnaes and Bergen, even amounting to a stiff gale at the latter station. Plate XXXVII. shows that the barometer continued to fall during the day, and reached its lowest point at Armagh at 10.30 p.m., and at Glasgow at 1 a.m. next morning.

April 3. By this morning the barometrical change had been less in the west than elsewhere, so that the gradient from Valencia to Aberdeen had increased to 7. The winds had drawn to N.W., and were much fresher, with snow showers on the west coast. The following table shows the observatory records for the day, from which it appears that the gale was not of much consequence anywhere. It lasted longest on the Channel coast.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	—	—	—	—	—	—	—	—	—	7 p.m. (3rd).	N.N.W.	28	—
Armagh	—	—	—	—	—	—	—	—	—	4 p.m. (3rd).	N.W. by N.	21	—
Glasgow	—	—	—	—	—	—	—	—	—	8 p.m. (3rd).	W.N.W.	31	The velocity of 30 miles an hour was reached occasionally during the day.
Aberdeen	5 p.m. (3rd).	W.	8 p.m.	N.W. by W.	44	7	11 a.m. (4th).	N.W. by W.	18	2 a.m. (4th).	N.W. by W.	48	—
Sandwick	—	—	8 p.m. (3rd).	N.W. by N.	44	8	6 a.m. (4th).	W.N.W.	10	11 p.m. (3rd).	N.W. by N.	49	—
Falmouth	3 p.m. (3rd).	N.	—	—	—	—	3 p.m. (4th).	N.N.W.	24	5 p.m. (4th).	N.N.W.	37	—
Stonyhurst	—	—	—	—	—	—	—	—	—	4 p.m. (3rd).	W. by N.	26	—
Kew	—	—	—	—	—	—	—	—	—	9 a.m. (4th).	N.	22	—

April 4. The depression continued to advance southwards, and a rapid recovery is noticed in the north and west. The winds this morning are remarkably irregular in direction, being moderate from N. and N.W. over these islands, except at the southern and south-eastern stations, where they have veered to N. and N.E. A strong N.N.E. gale is reported from Cape Gris Nez, which is confirmed by the observations at our south-eastern stations, and is apparently induced by a local barometrical depression existing over Flanders, while along the west coast of France a high S.W. wind is blowing, gales from that quarter being recorded at Rochefort and Biarritz, and from W. at Toulon.

April 5. The rapid increase of pressure had extended to the Channel coast, the rise at Cape Gris Nez exceeding 0·7 in., so that the winds had fallen light, and backed to W. However, the westerly wind had not moderated to any great extent in the south of France.

During the next few days the weather does not present many features of interest; a slight barometrical depression passed over our southern stations on the 6th and 7th (Plate XXXIX.), causing the wind to freshen from S.W. at Valencia and over the Irish Sea, and from W.N.W. in the north of Scotland; and bringing with it a good deal of rain, with thick weather on our west coasts. This disturbance affected the French stations on the 8th, while at the same time a considerable increase took place in barometrical readings over Norway, which is also noticeable at the Scotch observatories. Accordingly light easterly winds were felt at Yarmouth and across central England to the Irish coast, while the S.W. wind was still blowing in France. These conditions caused a fall in temperature of upwards of 10° on the east coast of England, producing a fog at several stations, which was remarkably dense in London. The rise of the barometer continued during the day in the north, and by the morning of the 9th the wind had veered to S.E., blowing a moderate breeze on the south-west coast of Ireland, where the weather was foggy and wet.

April 10. A barometrical depression, exceeding 0·3 in. in the extreme north, appears at 8 a.m. at the Scotch stations, where the wind shifted towards S.W., with rain. At Aberdeen the thermograms, Plate XXXIX., show some remarkable oscillations about noon.

In England, generally, fine weather was reported with light winds, but at Valencia the S.E. wind increased to the force of a slight gale for five hours from 5 p.m. This disturbance was not felt at any other observatory.

April 11. A general rise of the barometer is noticed in Great Britain and France, with a considerable increase of temperature on our east coast; the sky cleared almost completely, and winds were for the most part light from S.W., except at Valencia, where a strong S.E. breeze blew all day long.

There was but little to remark during the next few days, excepting that foggy weather still prevailed on the west coast of Ireland, and that the wind at Valencia after moderating during the early morning hours of the 12th, again increased to the force of a gale for a few hours in the evening, and lasted with a velocity exceeding 30 miles an hour until noon on the 13th. As on the previous days, this wind was not felt at any other observatory.

There was, however, some disturbance of weather over the Atlantic near our coast on the morning of the 12th, for Capt. A. Murray, of the barque "Sir Colin Campbell," outward bound from Peterhead to Greenland, reports a fall of the barometer during the 11th of about 0·5 in., and a slight S.E. gale, when he was about 120 miles north of Rockall. This wind was not experienced at Aberdeen.

April 14. A decrease in pressure appears at all our stations, being most extensive at those on the Channel coast, where readings had previously been highest. Accordingly the chart shows a remarkable uniformity in the distribution of pressure at 8 a.m., winds consequently being very light and variable. There was no diminution of fog on the west coast.

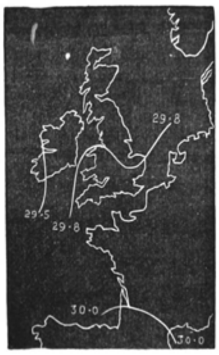

Fig. 34. April 15.

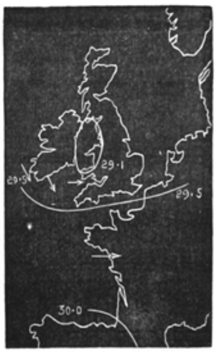

Fig. 35. April 16.

April 15. The fall of the mercury had continued over western Europe, and during the night had been rapid in the west of Ireland (Plate XLI.), so that the chart (Fig. 34) for this morning shows the approach of a depression from the Atlantic to our coasts. Temperature had fallen at most stations, and the wind at Valencia had again backed to S.E. and freshened, while in France it continued moderate from W.

Heavy thunderstorms were reported from Scotland.

In the evening a magnificent auroral display was observed over the greater part of Europe, from the Azores to Central Germany. It was noticed at considerable length in the "Comptes Rendus." Capt. Watson, of the "Palmyra," also recorded it.

April 16. Fig. 35 shows the depression situated over the Irish Sea, where there has been a rapid decrease. The gradients from Valencia to Holyhead being 10·2, heavy N.W. gales were blowing on the south coast of England. In the English Channel the wind was fresh from S.W., but in Scotland and Norway, where the gradients were slight, a moderate N.E. breeze was felt. Rain was general but not very heavy. The sea was very high on the Irish coast.

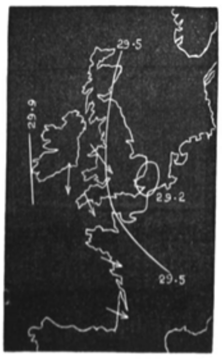

Fig. 36. April 17.

April 17. We see from Fig. 36 that the area of depression had crossed England by 8 a.m., its centre at that hour being in the neighbourhood of Yarmouth. A recovery of about half an inch is reported in the west, and the north-westerly gales have advanced to the Channel and Bay of Biscay.

The following are the particulars of this storm at the only two observatories where it was felt.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	3 a.m. (15th).	S.E. by S.	4 p.m. (15th).	S.W. by W.	44	15	9 p.m. (16th).	N.W. by W.	42	4 a.m. (16th).	W. by N.	48	—
Falmouth -	Midnight (15th).	W. by S.	6a.m. (16th).	W. by S.	45	33	9 a.m. (18th).	N.	57	11 a.m. (16th).	W. by N.	50	The wind moderated slightly for a time on the evening of the 17th.

The gale was also felt by the "Panic," Capt. E. J. Blake, the "Scotia," Capt. Judkins, "Palmyra," Capt. W. Watson, and the "Christabel," Capt. H. F. Watt; all these vessels were in longitude 10° to 15° W. Mr. Greenwood, the observer on board the "Scotia," reports that at 1·30 a.m. on the 15th "the wind came out N.W. 9, slight showers and clear sky." The barometer did not change much until noon, when it began to fall briskly and the wind backed slightly, continuing to blow hard.

April 18. A rapid rise of the barometer had occurred on our coasts, and the area of least readings was now situated over the Adriatic. The winds in these islands had veered to N. and N.E., and were fresh: the N.W. gales still continuing in France.

April 19. There was not much to remark, except that the barometer began to fall again in the west, and the winds backed to the southward, being moderate in force except at Valencia, where a strong south-east breeze was felt up to noon. The north-westerly winds in France had scarcely abated.

The barometrical depression just alluded to passed on to the south of England, and was more decidedly marked at Falmouth, where the minimum reading was reached at 3·15 p.m. on the 20th, than at other stations. The rainfall throughout the day was heavy in the western parts of these islands.

April 21. The barogram at Valencia (Plate XLIII.) again shows a reduction of pressure in the afternoon, which affected the other stations, but in a much less degree than the Irish ones. The only observatory at which the wind, which had backed to S. and S.E., attained the force of a gale was Valencia, where the velocity of 30 miles an hour was reached at 8 p.m., and the average velocity for seven hours, from 3 a.m., 22nd, was 42 miles an hour.

From this date to the 25th barometrical readings were remarkably uniform, and the weather was fine and dry, while the daily range of temperature shown by the thermograms, Plates XLV. and XLVII., was very extensive. On the morning of the 26th the mercury began to fall at all the southern and south-western stations, while at the same time there was a rise in the extreme north. These conditions at once produced easterly winds in France. Light S.E. breezes were reported from our own south coasts.

These changes of pressure made further progress during the 27th, and accordingly the easterly winds became more general, and increased in force.

April 28. A brisk rise of the mercury in the north had caused the Scotch readings to be very high, 30·67 at Aberdeen, from which station there was a gradient of 6·5 to Brest. The easterly winds increased in force to a strong breeze at most of the observatories, as the following table shows.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	Noon (28th).	E. by N.	—	—	—	—	4 a.m. (29th).	E. by S.	16	11 p.m. (28th). to 1 a.m. (29th).	E.	35	—
Armagh -	—	—	—	—	—	—	—	—	—	7 p.m. (28th).	E.N.E.	22	—
Glasgow -	8 a.m. (28th).	E.N.E.	—	—	—	—	6 p.m. (28th).	E.	10	5 p.m. (28th).	E.	32	—
Aberdeen -	—	—	—	—	—	—	—	—	—	4 p.m. (28th).	N.E. by E.	28	—
Sandwick -	—	—	—	—	—	—	—	—	—	5 p.m. (28th).	N.E.	21	—
Falmouth -	10 p.m. (28th).	E. by N.	4 a.m. (29th).	E.	40	2	Noon (29th).	E. by S.	14	4–6 a.m. (29th).	E.	40	On the evening of the 29th the wind veered to E.S.E., and then backed to E. and freshened.
	10 p.m. (29th).	E.	—	—	—	—	8 a.m. (30th).	E.	10				
Stonyhurst -	—	—	—	—	—	—	—	—	—	8–10 a.m. (28th).	E.N.E.	24	—
Kew - -	—	—	—	—	—	—	—	—	—	4 p.m. (28th).	E.N.E.	30	—

April 29. The conditions of pressure were not much altered from those of the previous day, but as we see from Fig. 37, the wind was blowing with the force of a fresh gale at Holyhead, as well as on the south coast of Ireland, and at the entrance of the Channel.

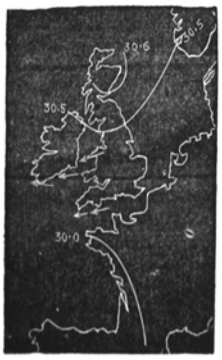

Fig. 37. April 29.

April 30. The high pressure in the north gave way, so that the gradients became less and the wind moderated, lasting longest in the south of Ireland.

May 1. The barometer continued to fall in the north, but as the area of highest readings was still situated over the north of England, light easterly winds were prevalent in the Channel, veering to south at Valencia. A very considerable barometrical depression existed over Russia, the reading at Moscow being as low as 28·83. Under the influence of this disturbance the winds in Norway were fresh to a gale from west at Skudesnaes and Christiansund, and veered to N.W. in the course of the evening. In these islands weather was fine and dry, but the temperature rather low. These conditions underwent little change over the United Kingdom up to the 3rd, while the depression existing over Russia gradually disappeared.

May 3. Readings were nearly uniform, ranging from 30·12 at Aberdeen and 30·13 at Rochefort to 29·78 at Valencia. Temperature continued low, and the wind swept round the area of diminished pressure, being southerly on the west coast of France, south-easterly in England, and easterly in Scotland.

During the day a slight depression advanced eastwards, being most marked at Kew, at which station the hollow was registered at midnight (Plate XLIX.).

May 4. The influence of the depression just noticed is clearly perceptible at the Channel stations, where the fall of the mercury amounted to about 0·2 in. To the north of this area the winds had all become easterly and freshened, even to the force of a gale at Holyhead, while at the observatories the velocity nowhere exceeded 20 miles an hour. In France the wind veered to S.W. and W. This change of weather brought heavy rain over England, the fall in the south-western counties exceeding an inch.

The Scotch observatories show that the temperature fell very low during the night of the 4th.

The report from Corunna shows the approach of an independent barometrical oscillation to the Spanish stations, as the barometrical fall there was as great as on the Channel coast.

May 5. The south-western depression became more serious, and affected the French stations, while on our south-east coast and in Holland there was a rise of the mercury. Readings in these islands were generally south-easterly.

In the north of France the equatorial current had given place to light easterly winds induced by the relatively low readings in the south, where the report from Corunna was 29·59.

In the course of the day an extensive reduction of pressure is shown at all the observatories, but as it was very uniform in amount, the winds were not much affected, and continued light or moderate. At Falmouth, however, a remarkable oscillation is noticeable in the barogram at 4 p.m., coincident with a temporary "veer" of the wind from E. by N. to S.S.E. (Plate XLIX.)

May 6. Fig. 38 shows an area of depression lying off the south coast of Ireland. The fall of the barometer has ranged from 0·5 to 0·65 in. at all our stations, but has been less in France, though still considerable there. Gradients being slight the winds have not increased in force; they have, however, drawn to N.E. in the north.

Rain has been very general, with thunderstorms, in the west of England.

Plate LI. shows that the mercury continued to fall at all stations throughout the day. At Aberdeen the N.E. wind increased to the force of a strong breeze at 6 p.m., and lasted all night; and at Valencia a stiff northerly breeze set in at 4 a.m. on the 7th, and lasted till the afternoon.

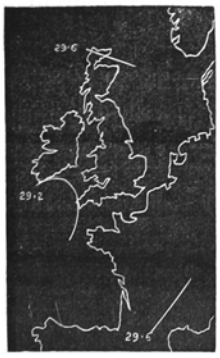

Fig. 38. May 6.

May 7. Fig. 39 shows us readings lower than on the previous day. A long trough of low pressures extends from S.W. to N.E. across these islands, the gradient from Nairn to Shields being 6. In the south of France pressure has undergone less change than with us, so that the S.W. winds have increased in force over that country. On the north-west side of the area of depression the wind is north-easterly, moderate to fresh in force, and even amounting to a gale at Cape Clear.

Rainfall was very heavy in the region of these easterly winds, and was general elsewhere.

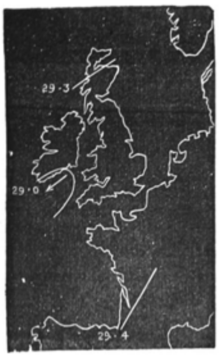

Fig. 39. May 7.

The barometrical hollow had passed over all our stations by noon, and afterwards pressure began to recover very rapidly, both in the north and extreme south; however at Falmouth a slight fresh fall of the barometer is noticeable, commencing at 8 p.m. and reaching a minimum at 4 a.m. This was accompanied by a recurrence of the strong northerly winds at Valencia, which began at 11 p.m. and lasted 14 hours.

May 8. Fig. 40.—The depression is now reduced in extent, and situated at the entrance of the Channel, where the rise has been but slight. The gradients are much steeper, being 8 from Greencastle to Pembroke, and 8·5 from Biarritz to Brest. N.E. gales are consequently reported from Cape Clear and Holyhead; while in the Bay of Biscay the wind has increased to a gale from W.

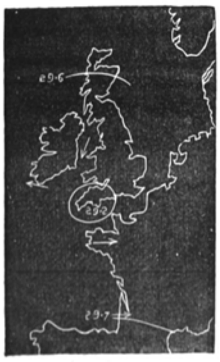

Fig. 40. May 8.

May 9. A general increase of pressure, amounting to 0·5 in. on the south coast of England, has occurred all over northern and central Europe; however, during the night a slight fresh decrease has shown itself in Ireland. The area of lowest readings is still situated off the south coast of that island. The equatorial current is blowing with moderate force in France, and the polar over the major part of the United Kingdom, showing that the atmosphere is still in an unsettled condition. Weather is, however, fine. The fall of the barometer just mentioned extended to all our stations, and by 8 a.m. on the 10th the area of reduced pressure had advanced to central England. Readings were, however, very uniform.

The winds were unaltered in direction from the previous day, and the only change which had occurred was that rain set in generally, and was very heavy in Devon and Cornwall.

May 11. A brisk recovery at our stations, especially at those in the west, caused the winds over these islands to veer to N.W., with clearer weather. This rise of the mercury continued through the 12th, while the winds became lighter.

May 13. A depression of about 0·2 in. is reported from the Spanish stations, while the increase at our own made further progress, so that the gradients for east winds increased. This wind set in along the Channel and over the north of France, attaining some force in the Bay of Biscay. At Toulon also there was a gale from E.N.E. At 11 p.m. the velocity of 30 miles an hour was reached at Falmouth, with an east wind, and maintained for 36 hours. The wind rose to a gale at 5 a.m. on the 14th, and continued with an average velocity of 43 miles an hour, for nine hours from that time.

A very brilliant aurora was seen over western Europe on the night of the 13th–14th.

May 14. (Fig. 41.) The area of depression has advanced to the west coast of France, and the gradient from Scarbro' to Brest has become 8·5. The gale is blowing from E. along the Channel coast, and from E.S.E. at Cape Clear. At Kew a strong easterly breeze set in at 8 a.m., lasting eight hours. At Yarmouth the gale began at noon.

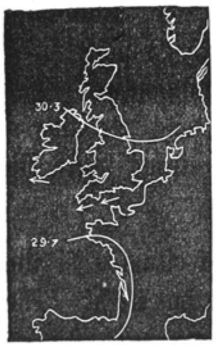

Fig. 41. May 14.

May 15. A general decrease of pressure ensued on this day and the next, which was least in amount at our south-western stations. The gradients were therefore reduced, and the easterly gales died down. At the same time, however, the equatorial current began to show itself with some force in Spain, and by the morning of the 16th fresh westerly and north-west winds were blowing over the Bay of Biscay.

During this day the barometer continued to fall, especially in the south-west, and Capt. Spragge, in the "Mary Hardy," in longitude 15° W., and on the parallel of Brest, met a moderate S.W. gale with a steadily falling barometer.

May 17. An extensive area of depression has made its appearance off the south coast of Ireland, and the easterly winds have been almost entirely displaced over western Europe, except in the northern portions of these islands. A fresh S.W. wind is reported on the French coast, with a stiff N.W. gale at Corunna.

This depression advanced slowly to the eastward, and by the morning of the 18th the wind at Valencia had veered to north, and the barometer began to rise briskly in the afternoon.

May 19. The increase of pressure had amounted to 0·3 in. at Valencia, and the winds at the western stations had veered towards N.W., and had freshened. This change extended to the coast of England in the course of the day, and a N.W. gale was reported in the Irish Channel, with a strong breeze at Falmouth from the same quarter, lasting for 10 hours from 8 a.m.

May 20. The area of low readings had advanced over the North Sea, and moderate N.W. breezes were felt in the United Kingdom. However, a serious fall of the barometer amounting to 0·4 in. is reported from Corunna, with fresh S.W. winds, and during the day pressure decreased at the French stations likewise.

May 21. Weather was unchanged over these islands, with light northerly and north-east winds, while a stiff westerly gale swept over the south of France.

May 22. A rapid rise of the barometer had occurred in the south and south-west, amounting to 0·60 in. at Rochefort, so that pressure this morning was very uniform and winds consequently light. These conditions were not much altered on the 23rd, when the highest readings (above 30·1 in.) are found in France, winds continuing light and variable. However, Plate LVII. shows us that the barograms at Valencia and Falmouth had already begun to show a decrease of pressure, which extended to all but the Scotch observatories in the course of the day. The wind also had veered to S.E. at Valencia, and was backing towards S. at Falmouth.

May 24. The fall of the barometer had been general in the west, and the area of readings above 30 ins. was restricted to a narrow strip along our eastern coast, extending down into central France and to Spain. Under the influence of the western depression the winds in the north drew to the eastward and freshened. During the day the reduction of pressure began to affect the stations on the coast of the Bay of Biscay, so that by the morning of the 25th the wind had backed to east at Valencia.

May 26. We find that the barometer has fallen nearly uniformly at all the Channel stations, and the centre of depression is situated near Brest. The gradient from Ardrossan to Pembroke is 8; consequently a N.E. gale was felt at Holyhead, and at Valencia the velocity of 30 miles an hour from N.E. by N. was reached for six hours from noon. Weather on the whole was very cloudy, with rain on our south and west coasts.

May 27. A general rise of the barometer occurred, as will be seen from Plate LIX. It was nearly uniform in amount at the northern and southern stations, so that the gradients for easterly winds remained unaltered, and the gale continued at the same stations as before.

There was not much change on this day over the United Kingdom, excepting that the increase of pressure was most rapid in the west and north. However, strong northerly to north-easterly gales were reported by the "Cuba," Captain Moodie, in 50° N. and 16° W.; as also by the "John Temperley," Captain J. W. Tucker, in the same longitude, and on the parallel of Cape Finisterre.

May 28. Easterly winds were general over these islands, blowing very fresh along the Channel coast, while the gales were still reported from Holyhead and Cape Clear. The ships just mentioned experienced very heavy weather, as did also the "Mervyn," Captain T. E. Hassell, off the south coast of Ireland. In the course of the day, however, the barometer rose steadily in the south of England, while a decrease showed itself at the Scotch observatories; gradients were accordingly reduced, and the wind gradually moderated.

May 30. The reduction of pressure had become greater in Scotland, so that the winds backed to west at the northern stations, remaining moderate in force.

There was no important change in either pressure or temperature within the next few days, and weather continued fine with light winds, which were for the most part westerly, until the 7th of June, when we see from Plate LXIII. that the barometer was falling at all the northern stations. At Aberdeen the lowest reading was recorded at about 2 a.m. on the 8th, and a rapid recovery at once set in, the wind veering from W. to N.W. and blowing rather fresh until noon.

June 8. We learn from the Norwegian reports and the Bulletin International that an area of depression was in process of formation at 8 a.m. at the head of the Gulf of Bothnia. Under its influence N.W. winds have become general over Great Britain, blowing with the force of a strong breeze at Sandwick in the Orkneys, and veering to W. in Holland. Temperature also has fallen rapidly at our northern stations.

June 9. The eastern depression continues unchanged in position, but has increased in magnitude. Winds are lighter over these islands, but are still fresh from N.W. in the extreme north, at Aberdeen and Sandwick.

June 10. The centre of depression had advanced southwards to St. Petersburgh, where a strong S.E. wind was reported. Winds with us again freshened from north, especially at Aberdeen, and the weather became cold at our northern stations.

June 11. The barograms (Plate LXV.) show the steady advance from the north-west of an extensive depression which continued in progress during the 12th, and produced great uniformity in barometrical readings on that day, rendering the winds very light, with fine weather.

June 13. The fall had been greatest during the night over central England, and this morning we see (fig. 42) that although no great difference exists in readings, two distinct areas of depression are observable. The minimum pressure was recorded during this day at the Irish and Scotch observatories, but was not observed at those in the south of England until next day.

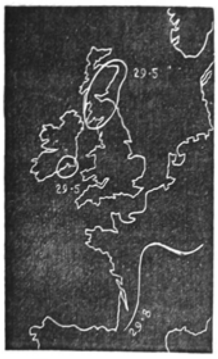

Fig. 42. June 13.

June 14. The decrease continued in progress in the south of England, but had been succeeded by a slight recovery in the north and west, so that fig. 43 exhibits an oval area of readings below 29·4, extending from London to the Helder. Gradients were steepest on its western and southern sides, so that fresh northerly and westerly winds were felt. A considerable amount of rain fell in the south-east of England.

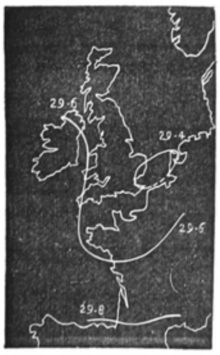

Fig. 43. June 14.

The barograms from Falmouth and Kew show that the minimum pressure was registered at these stations in the forenoon, the curve at Kew exhibiting some noticeable irregularities. At 8 a.m. the gradient from Roche's Point to London was as much as 8, and accordingly the wind freshened from N. at Falmouth. Temperature fell rapidly on our east coast.

In the south of England an immediate brisk recovery occurred, which may be remarked on Plate LXV. It extended to the French coast during the day, but was strictly local, as we see that a sudden decrease had set in at the Irish stations, which passed over all the observatories except Aberdeen. Its rate of advance was irregular, for it was registered at Valencia and Armagh at midnight, and Glasgow and Falmouth about 4 a.m. At Stonyhurst the mercury remained at its lowest level for about six hours from 4 to 10 a.m. At Kew the minimum appeared at 8.30 a.m.

Of this oscillation not a trace is discoverable in the daily weather reports, as it passed over almost entirely between the hours of 2 p.m. on the 14th and 8 a.m. on the 15th.

June 15. The comparison of the other barograms with that from Stonyhurst (Plate LXVII.) enables us to understand the conditions of pressure represented by fig. 44. The rise of the barometer, which was general except in the north of England, produced a local depression over that district, with its own wind circulation. Apparently this disturbance did not extend to Norway, for the wind at Skudesnaes was not affected by it.

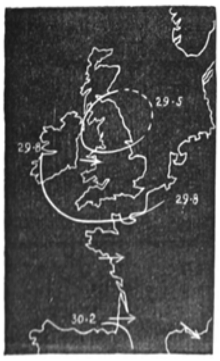

Fig. 44. June 15.

The minimum pressure was situated somewhere in the south-east of Scotland, and gradients on its northern and western sides were rather steep. At Aberdeen a strong breeze from E. was recorded in the morning. At Glasgow the velocity of 40 miles an hour from N. was felt for three hours from 9 a.m. to noon. A westerly gale was reported at Holyhead; and at Falmouth a strong breeze from W. veering to N.W. was felt from midnight on the 14th until 6 p.m. on this day. In the south of France stiff westerly gales were reported. Weather was generally cloudy with rain.

The recovery in pressure, which was rapid in the north and west, hardly set in at Kew until the morning of the 16th. Accordingly the barometrical depression advanced to the south-east, while gradients became much steeper on its western and north-western sides. The result of these changes was to produce heavy northerly gales in the north of England during the night, which did an immensity of damage to the fishing fleet on the coast of Yorkshire. The observer at Scarborough reports on the authority of the fishermen that the gale began off Hartlepool shortly after midnight from N.E., backing to N.

June 16. Fig. 45 shows us the depression situated off the coast of Norfolk, with a gradient of 9 from Penzance to Yarmouth. The rise of the barometer has been as much as 0·5 in. at Scarborough and 0·38 in. in London, while at Yarmouth it was only 0·07 in., and at the Helder an actual fall is observable. A very severe northerly storm is blowing at Scarborough, and a gale from N.W. and W. over Belgium. The gale did not reach Yarmouth until noon, at which time the barometer at that station had risen 0·3 in. since 8 a.m., and it only lasted for five hours. The rainfall along the N.E. coast of England was very heavy.

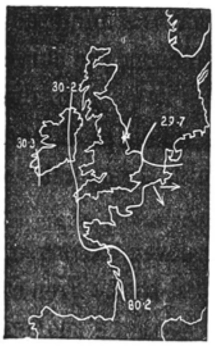

Fig. 45. June 16.

June 17. A brisk rise of the barometer, amounting to 0·6 in. at Helder, is noticeable at all our eastern stations. Readings are extremely uniform, and winds consequently light. Next day a slight decrease appeared on the coast of the North Sea, which produced light northerly winds.

From this date until the 24th there was no change of any note to report. The barometer remained very steady; the wind was light, and mostly from points between N.W. and N.E. Temperature was remarkably uniform, ranging between 50° and 55°, and the sky remained constantly overcast, although the weather was dry. On the 24th the sky began to clear and weather became warmer, at first in Scotland, and subsequently at the southern stations. Weather on the whole continued fine till the end of the month, with very light winds, which were variable in the north, and easterly in the Channel. In France, however, a fresh easterly wind was prevalent.

REMARKS.

Wind.—The following table* shows the number of hours during which the wind blew with a velocity of 30 miles and upwards, irrespective of its direction, at the several observatories, during the quarter.

Observatory.	April.	May.	June.	Total.	Observatory.	April.	May.	June.	Total.
Valencia	112	54	19	185	Sandwick	31	9	24	64
Armagh	0	0	0	0	Falmouth	110	66	18	194
Glasgow	19	6	4	29	Stonyhurst	0	0	2	2
Aberdeen	24	20	17	61	Kew	2	16	0	18

On comparing this table with that given in Part I. for the first three months of the year, some remarkable differences may be observed. The influence of local circumstances in checking the motion of the air is as clearly marked as before; but whereas in the first quarter the number of miles of wind which passed Valencia with the requisite velocity was greater than that at Falmouth, in the proportion of about 7 : 5, in the quarter now under discussion the figures at these two stations are nearly identical, and are three times as high as those from any other station.

At Armagh the wind never reached the velocity of 30 miles an hour at all, and at Stonyhurst that speed was only registered for two hours in June.

The reason of the excessive velocities at Falmouth and Valencia is to be sought for in the easterly winds which were prevalent, and which sweep down the English Channel and along the south coast of Ireland with considerable force, while at the other stations their motion is checked or impeded by the contour of the land.

Pressure.—

April.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia	29·952	—	30·283	25th, 11 a.m.	29·306	16th, 1 a.m.	0·977
Armagh	29·965	+0·061	30·505	29th, 1 a.m.	29·002	16th, 4 a.m.	1·503
Glasgow	29·980	+0·087	30·631	28th, 9 p.m.	29·163	16th, 10 a.m.	1·468
Aberdeen	29·916	0·000	30·686	28th, 1 p.m.	28·983	3rd, 5 a.m.	1·703
Falmouth	30·027	+0·024	30·364	12th, 8 p.m.	29·361	16th, 10 a.m.	1·001
Stonyhurst	29·981	+0·099	30·517	28th, 10 p.m.	29·047	16th, 11 a.m.	1·470
Kew	30·018	+0·050	30·377	29th, 6 a.m.	29·155	16th, 6 p.m.	1·222

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* These tables are precisely similar to those given in Part I., p. 31.

This table shows us that pressure was in excess at all the stations except Aberdeen, the amount of this excess being greatest at Stonyhurst, where it was nearly a tenth of an inch.

The maximum as well as the minimum readings, and consequently the greatest range, were registered at Aberdeen.

May.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	29·780	—	30·342	29th, 10 p.m.	28·985	7th, 3 a.m.	1·357
Armagh - -	29·888	—0·034	30·352	13th, 11 a.m.	29·097	7th, 3 a.m.	1·255
Glasgow - -	29·907	—0·002	30·375	14th, 1 a.m.	29·146	7th, 3 a.m.	1·229
Aberdeen - -	29·890	—0·062	30·389	13th, midngt.	29·190	7th, 4 a.m.	1·199
Falmouth - -	29·807	—0·198	*30·319	31st, midngt.	29·071	7th, 3 a.m.	1·248
Stonyhurst -	29·858	—0·050	30·360	29th, 10 p.m.	29·001	7th, 3 a.m.	1·359
Kew - -	29·834	—0·132	*30·280	31st, midngt.	29·141	7th, 4 a.m.	1·139

In this month we notice a considerable deficiency of pressure, which was greatest in the south of England, where it amounted to almost 0·2 in. This latter result is not surprising, as it will be noticed that three easterly gales occurred during the month.

The highest reading was registered at Aberdeen and the lowest at Valencia, while the greatest range occurred at Stonyhurst. The minimum readings were registered at all the observatories within an hour of each other.

June.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·161	—	30·438	22nd, midngt.	29·551	13th, 6 a.m.	0·887
Armagh - -	30·225	+0·308	30·390	27th, 9 p.m.	29·363	14th, midngt.	1·027
Glasgow - -	30·033	+0·144	30·352	28th, 6 a.m.	29·328	15th, 4 a.m.	1·024
Aberdeen - -	30·041	+0·120	30·388	28th, 7 a.m.	29·465	13th, 10 a.m.	0·923
Falmouth - -	30·137	+0·090	30·435	16th, 10 p.m.	29·498	14th, 3 a.m.	0·937
Stonyhurst - -	30·072	+0·152	30·368	28th, 7 a.m.	29·387	15th, 11 a.m.	0·981
Kew - - -	30·094	+0·114	30·352	17th, 2 a.m.	29·389	14th, 6 a.m.	0·963

Barometrical readings were above their average values at all the observatories, even to the extent of 0·3 in. at Armagh. The highest reading was registered at Valencia, the lowest at Glasgow, and the greatest range at Armagh.

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* These values differ from those given for Falmouth and Kew in Table I., as civil time being used here, the values given in the table would fall in June.

Temperature.—

April.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	51·9	—	69·6	27th, 4 p.m.	37·4	3rd, 5 p.m.	32·2
Armagh - -	48·5	—	69·1	11th, 3 p.m.	32·1	2nd, midngt.	37·0
Glasgow - -	47·1	+2·2	69·6	11th, 3 p.m.	30·0	9th, 5 a.m.	39·6
Aberdeen - -	46·1	+3·0	66·9	12th, 4 p.m.	30·0	9th, 5 a.m.	33·9
Falmouth - -	49·9	—	63·6	27th, 1 p.m.	37·4	3rd, midngt.	25·8
Stonyhurst - -	48·5	+4·0	73·1	14th, 1 p.m.	32·9	3rd, 3 a.m.	40·2
Kew - - -	51·0	+5·2	74·5	14th, 3 p.m.	29·5	2nd, 5 a.m.	45·0

Temperature was above the average during April to the amount of four or five degrees in England. The extremes were registered at Kew, and consequently the greatest range, which was considerable, being 45°.

May.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	51·4	—	63·4	24th, 4 p.m.	40·1	12th, 4 a.m.	23·3
Armagh - -	46·7	—	62·5	1st, 4 p.m.	33·8	9th, 5 a.m.	28·7
Glasgow - -	45·5	−4·9	65·0	1st, 4 p.m.	32·0	9th, 5 a.m.	33·0
Aberdeen - -	44·3	−3·9	57·0	1st, 1 p.m.	30·5	5th, 4 a.m.	26·5
Falmouth - -	51·6	—	60·9	23rd, 1 p.m.	40·2	30th, 4 a.m.	20·7
Stonyhurst - -	46·5	−3·4	60·3	1st, 3 p.m.	36·2	13th, 4 a.m.	24·1
Kew - - -	51·5	−1·0	68·7	26th, 4 p.m.	35·3	30th, 5 a.m.	33·4

In May the weather became colder again, especially at the northern stations. However, the mercury did not sink below the freezing point except at Aberdeen. The highest reading was recorded at Kew, as well as the maximum range.

June.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	56·8	—	74·3	30th, 6 p.m.	45·8	14th, 4 a.m.	28·5
Armagh - -	54·5	—	71·0	25th, 1 p.m.	36·5	14th, 3 a.m.	34·5
Glasgow - -	54·2	−1·6	71·5	25th, 4 p.m.	38·8	10th, 4 a.m.	32·7
Aberdeen - -	52·0	−3·0	67·3	25th, 2 p.m.	40·3	16th, 3 a.m.	27·3
Falmouth - -	56·5	—	70·1	7th, noon	47·1	17th, 2 a.m.	23·0
Stonyhurst - -	54·5	−0·2	72·5	6th, 5 p.m.	41·0	12th, 3 a.m.	32·5
Kew - - -	56·4	−1·7	82·0	7th, 3 p.m.	40·6	17th, 2 a.m.	41·4

In June the temperature continued slightly lower than the average. The highest recorded reading was at Kew, and the lowest at Armagh. The greatest range was noticed at Kew.

The comparison of the five-day-means for Kew with those given by Dove for Greenwich gives the following results:—

Dates.	Variation.	Dates.	Variation.	Dates.	Variation.
April 1– 5 -	+ 2°·3	May 1– 5 -	+ 2°·3	May 31–June 4 -	−1°·7
„ 6–10 -	+ 7·2	„ 6–10 -	− 2·8	June 5– 9 -	+1·4
„ 11–15 -	+ 6·2	„ 11–15 -	− 0·2	„ 10–14 -	−4·9
„ 16–20 -	+ 3·8	„ 16–20 -	− 2·9	„ 15–19 -	−4·6
„ 21–25 -	+ 4·3	„ 21–25 -	− 1·0	„ 20–24 -	−3·6
„ 26–30 -	+10·6	„ 26–30 -	− 4·4	„ 25–29 -	−0·7

The warm period lasted from the beginning of April to the 5th of May, the excess being greatest at the end of April. From the 6th of May to the end of the quarter the weather was almost uninterruptedly colder than it ought to have been, but the defect was not great.

PART 3.

July 1. The quarter began with fine weather and easterly winds, which were much stronger over France than in these islands. On the 3rd a decrease of pressure showed itself in the west, which passed over the other stations during the next three days, while the wind shifted generally to the south-eastward, and the weather became warmer. The thermograms, Plate LXXIII., show a considerable daily range except at Aberdeen, where on the 3rd and 4th the weather was cloudy and misty. In France the north-easterly current still held its course. By the morning of the 5th the wind had veered to S. and S.W. at our western stations, and rain had set in on the south coast of Ireland. This change gradually extended itself to the northern part of Great Britain, and the south-westerly wind freshened generally, and even attained the force of a strong breeze at Sandwick for a few hours after noon on the 6th. The easterly winds over France were also almost entirely displaced.

July 7. A fresh slight decrease in pressure at Valencia, Plate LXXV., was accompanied by a freshening of the wind, which had backed during the previous evening from S.W. to S. by E. The velocity of 30 miles an hour had been reached at midnight, and lasted for 49 hours, while a gale from S. with average hourly velocity of 45 miles was felt from 1 p.m. till 5 a.m. on the 8th. This gale was not felt at any of the other observatories, but it swept along the Irish Channel, and out over the Firths of Clyde and Forth, for it was reported at Holyhead on the 8th, at 8 a.m., and at Ardrossan and Leith on the 9th, on which latter day the velocity of 30 miles an hour was exceeded at Glasgow for a few hours about noon. The strongest wind force reported from Greencastle was W.S.W. 7, but H.M.S. " Porcupine," at anchor in Lough Swilly, with the Dredging Expedition on board, experienced a slight S.W. gale during the night of the 8th. In the afternoon of the 8th a steady recovery of pressure set in at Valencia, which extended to the other stations during the succeeding day.

For the next fortnight, up to the 24th, there was no change of any serious consequence to record, either at our own or the foreign stations. Fine summer weather was prevalent, with light winds and a generally clear sky. The maximum temperature for the year was recorded at Armagh and Glasgow on the afternoon of the 17th, and at Falmouth on the afternoon of the 18th. At Kew the maximum reading was observed at 2 p.m. on the 22nd. It was 88°·3, and was the highest reading registered at any of the observatories for the year. On the night of the 12th, however, a strong S.W. breeze was felt at Sandwick, and the barogram at Aberdeen (Plate LXXVII.) shows a slight unsteadiness of pressure on that day, while a general decrease exceeding 0·2 in. is noticed at all except the Irish stations. This disturbance passed over to

Norway, where stiff westerly gales were felt at Christiansund and Aalesund on the 13th and 14th.

July 25. A sudden fall of the barometer is noticed at Valencia, while the wind backed to E.S.E. and increased considerably in force. The rainfall at this station was very heavy on this day, exceeding 1·3 in. at the observatory. This heavy fall was, however, very local, and the increase of force in the wind was confined to the south coast of Ireland.

From the 20th to the 28th high and uniform pressures, with light winds and fine weather, were again prevalent.

July 29. We notice a rapid fall in the Valencia barogram, which propagated itself to the north-eastward, being scarcely noticeable at Kew and Falmouth, and much less marked at Stonyhurst than at the Scotch observatories. The lowest reading was recorded at Valencia at 10.30 a.m. on the 29th, and the hollow passed out over Aberdeen at about 3.15 a.m. next morning, Plates LXXXIII. and LXXXV. At Valencia the wind backed to S. at midnight, and blew with a velocity exceeding 30 miles an hour for 10 hours, maintaining the average rate of 46 miles for 7 hours, and even that of 52 miles from 8 to 10 a.m. The gale was reported from all the stations in the south of Ireland and on the coast of the Irish Sea, and thus followed a course similar to that of the 7th, excepting that it did not cross Scotland to the Firth of Forth. It was not felt at any of the other observatories except at Falmouth, where a strong breeze from S.W. was recorded from noon till midnight. It is remarkable, as already noticed, that notwithstanding this increased force of the wind, the barogram at this latter station shows very slight traces of the oscillation which had passed over the northern stations.

July 30. The area of depression was situated in the north-east of Scotland. Gradients were slight, and the wind generally light from S.W. At Valencia and Cape Clear, however, a temporary increase of wind occurred about midday. Weather was overcast and rainy, and continued so till the 2nd of August, with occasional thunderstorms at some of the stations.

August 3. A slight barometrical depression passed over our southern stations, being most marked at Falmouth. It was accompanied by a temporary "back" of the wind which was greatest at Valencia. The weather, however, was not materially changed, and continued wet at all stations. On the 4th and 5th the barometer rose steadily, and reached a maximum at all the observatories on the 6th, on which day readings were high and very uniform, the wind fell light, and the sky began to clear.

August 7. A brisk decrease is shown in the barograms from the Scotch stations, where the wind shifted to south-west with rain, but without increasing seriously in force.

On the 9th the barometer rose generally, while the wind veered to N.W. and freshened at the south-western stations, reaching the force of a gale at Cape Clear, and also at Falmouth, for a few hours at midday, both on the 9th and 10th. Elsewhere a fresh breeze from the same quarter was prevalent, which gradually died down on the 12th, when the weather again became very fine, barometrical pressure scarcely varying for the next fortnight up to the 26th. Temperature rose very rapidly at the end of the period in question, and on the 25th the maximum reading for the month was registered at Aberdeen.

Fog had, however, been very prevalent at the southern and western stations, and was gradually extending itself along the west coast of Scotland, and on the night of the 25th the sky in the extreme north of Scotland became overcast.

August 26. Plate XCV. shows us that the temperature had undergone a considerable diminution about 5 a.m. both at Aberdeen and Stonyhurst. The sky at Aberdeen, Greencastle, and Nairn was reported overcast at 8 a.m., consequently the daily report exhibits a fall of several degrees in the thermometers at the northern and western stations, and a little rain fell. In the afternoon the barometer began to rise in the north, and the wind "backed" to east at Aberdeen, the effect of which change was to produce heavy cloud on the morning of the 27th, and almost entirely to cancel, at that observatory, the daily range of the thermometers, which had of late been very remarkable for its extent in all the thermograms, excepting that from Falmouth.

The sky cleared again on the night of the 27th, and the daily report for the 28th exhibits a great uniformity in barometrical readings, a general decrease being noticeable in the north, where, as will be remembered, there had been a rise on the previous day.

This depression was not nearly of so marked a character at the Irish observatories as at those in Great Britain. The records from Glasgow, Stonyhurst, and Kew show that the minimum was registered at Glasgow at 6 p.m., at Stonyhurst at midnight, and at Kew about 6 a.m. on the 29th. Most unfortunately the barogram at Aberdeen is deficient for the 28th and 29th, but the standard readings which were taken show that the barometer rose ·025 in. between 10 a.m. and noon on the 28th, fell ·005 by 2 p.m., and again rose ·061 by 8 p.m. The reports from Nairn exhibit a rise of ·07 in. between 8 a.m. and 2 p.m.

The changes of wind and the resulting variations of temperature were, however, much more marked than the comparatively slight nature of the barometrical fluctuations would have led us to expect.

From Plate XCVI. it appears that the wind at all the British observatories, except at Kew (where it remained easterly), underwent a great change in direction during the 28th, the vane being very unsteady and finally shifting towards N. and N.E. The change was more regular at Aberdeen than elsewhere. This cold air gradually found its way over Scotland during the afternoon, causing a most sudden and unusual fall of temperature, which subsequently extended to all the other stations. The northerly wind was felt locally as a gale in some parts of Scotland, but the highest velocity registered at any of our observatories before midnight was 24 miles an hour at Glasgow. Before 8 a.m. on the 29th, however, a gale from N. was felt at Greencastle and Ardrossan, and at 3 a.m. the anemograph at Holyhead* registered an hourly velocity of 30 miles from north, which increased at 8 a.m., and averaged 46 miles for 6 hours from 10 a.m.

Some interesting particulars of this very remarkable change of temperature will be found in a paper by Mr. Buchan, in the Journal of the Scottish Meteorological Society, vol. ii., p. 320, and also in Symons' Meteorological Magazine for September 1869. The Norwegian reports prove that its influence extended to those stations also.

The table of extreme readings for the month, which will be found at p. 79, shows the absolute amount of the change at all the observatories except at Kew, where the minimum reading 40°·3 was observed on the 1st of September at 5 a.m.; the range at that station was accordingly 46°·3. A study of Plates XCV. and XCVII. is, however, necessary in order to trace the entire course of the phenomenon.

It will be noticed that the oscillation was of least extent at Falmouth, where, as has already been stated, temperature had been more steady than at the other stations, owing to the easterly winds which had been prevalent in the Channel for some days. The range recorded by Dr. Hoskins in Guernsey was also very moderate, compared with that observed in these islands.

August 29. The area of barometrical depression had advanced to the south-east of England, the gradient at 8 a.m. from Leith to Helder being 6. The north-east gale already referred to was blowing at Holyhead, and at Valencia also a considerable increase of force is noticed. At 3.30 p.m. a heavy N.N.W. gale was reported from Yarmouth, and the wind freshened from N.E. at Kew. About midnight a strong breeze from the east sprung up at Falmouth and Plymouth, and north-easterly gales were felt during the night on the coast of Yorkshire.

August 30. The local depression in the S.E. of England moved further southwards, and the gales ceased, a fresh easterly breeze prevailing along the Channel coast.

September commenced with a few days of fine weather, but on the 3rd a steady decrease is observable in all the barograms, and the wind at Valencia veered to S.E. and increased in force, blowing as a strong breeze from noon till midnight. This wind extended during the night to Falmouth, where, however, the velocity was not so high as at Valencia. The breeze was not felt at any other observatory. During the day the sky at the western stations became overcast.

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* This instrument had been erected in the middle of the month, and commenced to work on the 20th.

Sept. 4. The greatest reduction of pressure had occurred at the Channel stations, and the lowest readings were situated near Brest. The barometer, however, continued to fall at Valencia and Falmouth, as appears from Plate XCIX.; and on the morning of the 5th the reports from the south of Ireland showed the existence of a small area, with readings below 29·6, embracing that district. Gradients were slight, so that there was little wind excepting at Falmouth, where a strong breeze from S.E. blew for a few hours about noon. By the morning of the 6th the entire disturbance had passed away to the north-eastward, the Norwegian barometrical observations exhibiting its effects on the 6th and 7th.

Sept. 7. A sudden fall is observable in the Valencia barogram, and the wind backed to south and quickly rose to a gale, which, however, only extended to three of the anemometrical stations and to Ardrossan. The barometrical oscillation passed off in a north-easterly direction like its predecessor.

Sept. 8. The barogram at Valencia, Plate CI., shows scarcely a trace of an oscillation during the day, but nevertheless the wind backed from S.W. to S. at 9 a.m., and again increased, reaching the force of a gale 24 hours later.

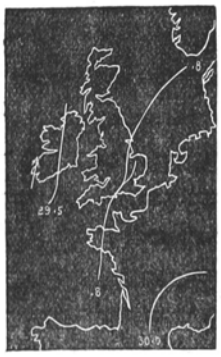

Fig. 46. Sept. 9.

Sept. 9. Fig. 46 shows us the isobar of 29·5 running from N. to S. across Ireland, the only gale blowing being that already noticed at Valencia, which increased at 9 a.m., the direction at the same time backing to S.E., Plate CII. On looking to the barogram, Plate CI., the reason of this gradual "back" of the wind is at once evident, for a brisk fall of the barometer set in at noon, and the lowest reading was registered at 7 p.m., while a steady decrease was in progress at all the other observatories.

This gale, like that of the 7th, was confined to our western coasts, though it attained considerable force at Valencia, at which station it lasted for a day and a half.

The following table gives the recorded particulars of these two short gales.

Observatories.	Velocity. 30–40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	8 a.m. (7th).	S. by W.	11 a.m.	S. by W.	47	10	10 p.m. (7th).	S. by W.	14	1–2 p.m. (7th).	S.	51	—
Falmouth -	4 a.m. (8th).	S. by W.	—	—	—	—	Noon (8th).	S. by W.	7	11 a.m. (8th).	S.	35	—
Holyhead -	Noon (7th).	S.	1 p.m.	S.	42	16	6 a.m. (8th).	S.	18	3 a.m. (8th).	S.	45	—

2nd Gale.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 a.m. (8th).	S. by W.	9 a.m. (9th).	S.S.E.	45	13	11 p.m. (9th).	S.W. by S.	36	6 p.m. (9th).	S.S.E.	51	—
Falmouth -	7 p.m. (9th).	S.	—	—	—	—	3 a.m. (10th).	S. by E.	8	9–11 p.m. (9th).	S.	33	—
Holyhead -	7 a.m. (9th).	S.	8 p.m. (9th).	S. by E.	40	4	2 a.m. (10th).	S. by E.	19	Midnight (9th).	S. by E.	41	—

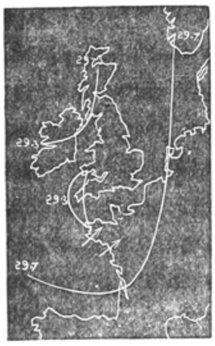

Fig. 47. Sept. 10.

Sept. 10. Fig. 47 exhibits a remarkable distribution of pressure at 8 a.m.; a rudely triangular area of readings below 29·3 lies across the south-west of England, while another independent area with pressure equal to it embraces the north of Ireland and the entrance to the North Channel. The gradients over these islands are slight, but that from Rochefort to Brest is as much as 10, so that a south-west gale is reported from the coast of Brittany.

The barograms for this day and the next, Plate CI., are not easy of interpretation, for the fluctuations of pressure are very irregular. The depression noticed on the 9th at Valencia apparently passed eastwards, for the "minimum" registered on the 10th respectively at Falmouth at 11 a.m., at Stonyhurst at 5.30 p.m., and at Kew at 7 p.m., appears to be due to the same disturbance as that which had passed over Valencia on the previous day. The northern observatories were affected in a much less degree than Valencia and the English ones; for while the barogram at Armagh shows a decided though slight "minimum" at 1 a.m. on the 10th, those for Glasgow and Aberdeen scarcely exhibit a trace of the oscillation, unless the slight nick in each of the curves, which may be detected at Glasgow at 7 a.m., and at Aberdeen at noon, is to be considered as representing it.

At the two Scotch observatories, however, the barometer continued to fall during the day, and this motion was much the more persistent at Aberdeen, so that a totally independent dip appears in the curve from that station, the lowest reading being registered at 3 a.m. on the 11th. This oscillation reached the Norwegian coast in the course of the day.

The wind on the 10th did not attain any serious violence on our coasts. At Falmouth a strong breeze from W.N.W. was felt for two hours about noon. At Portsmouth a S.W. gale was reported at 2 p.m., and at Kew the velocity of 30 miles an hour was exceeded, with a S.W. wind, from 2 to 7 p.m., while at all other stations the wind remained light, with cloudy and wet weather.

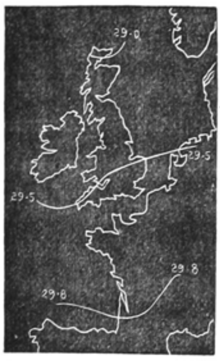

Fig. 48. Sept. 11.

Sept. 11. Fig. 48 does not exhibit a trace of the depression existing at Penzance on the previous day; the isobars run from W.S.W. to E.N.E., and pressure decreases regularly from 29·8 in the south of France to 29·0 at Wick. Winds are westerly and moderate in force, and temperature nearly uniform.

In the afternoon, however, a storm came on which was to the full as remarkable in its character as that of Feb. 12, already noticed in these pages, while in its violence, of which, fortunately, the full brunt was not borne by our coast, it far exceeded the gale of February. The Valencia barogram (Plate CI.) shows the commencement of a fall at midnight, and at that station the minimum was registered at 4 p.m. This oscillation is scarcely traceable at any of the northern observatories except Stonyhurst, where the hollow passed at 5 a.m. on the 12th. It was, however, along the Channel coast that the most striking phenomena were exhibited. The barometer at Falmouth began to fall rapidly at noon, the decrease of pressure between that hour and 10.30 p.m., when the minimum was recorded, amounting to 0·79 in.; the subsequent rise of the barometer was as sudden as the previous fall had been. At Kew the oscillation was similar in its character to that just described at Falmouth, but its extent was not so serious. The lowest reading was registered at 5 a.m. on the 12th.

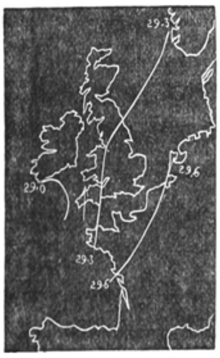

Fig. 49. Sep. 11., 6 p.m.

Figs. 48 and 50, for 8 a.m. on the 11th and 12th respectively, give us next to no information as to the nature of this storm, but fig. 49, which shows the distribution of pressure at 6 p.m., throws a good deal of light on it. At that hour we see that an area of readings below 29·0 in. lay off the south coast of Ireland, the barometers in the north having risen slightly since the morning, while the reduction of pressure had been much more rapid at the entrance of the Channel than elsewhere.

The log of the P. and O. Company's ship "Indus," kept by Mr. S. W. Hodding, a most careful observer, gives us some additional information of interest. This ship was homeward bound, passing outside the Bay of Biscay; at 6 a.m. on the 11th she was in lat. 46° 47′ and long. 15° 17′, when the gale commenced from S.S.W. with a rapidly falling barometer. The lowest reading 29·265 was observed at noon, and the recovery of pressure during the next 2 hours was 0·159 in., while the wind shifted to N.W., blowing harder than before. The gale abated at 6 p.m.

The subjoined table shows that the storm was extremely local, being strictly confined to the two southern observatories and to Holyhead.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	—	—	—	—	—	—	—	—	—	5 a.m. (12th).	W. by N.	26	—
Armagh	—	—	—	—	—	—	—	—		11 a.m. (12th).	W.S.W.	12	—
Glasgow	—	—	—	—	—	—	—	—	—	4 p.m. (12th).	N.W. by W.	19	—
Aberdeen	—	—	—	—	—	—	—	—	—	5 p.m. (12th).	W.N.W.	30	This velocity only lasted for one hour.
Sandwick	—	—	—	—	—	—	—	—	—	5 p.m. (12th).	W.N.W.	18	—
Falmouth	2 p.m. (11th).	S.	4 p.m. (11th). 11 p.m. (11th).	S. N.W. by W.	46 55	3 6	2 p.m. (12th).	W.	24	1 a.m. (12th).	N.W. by W.	73	The shift of wind from S.S.W. to N.W. by W. took place at 11 p.m., when the velocity fell to 20 miles for an hour. It then rose to 51, 73, 61, and 52 miles respectively during the next 4 hours.
Holyhead	11 p.m. (11th).	E.N.E.	3 a.m. (12th).	N.W.	48	5	2 p.m. (12th).	W. by N.	15	6 a.m. (12th).	N.W.	53	The direction is doubtful, as the vane was slightly stiff.
Stonyhurst	—	—	—	—	—	—	—	—	—	3 p.m. (12th).	W. by N.	31	This velocity only lasted for one hour.
Kew	8 a.m. (12th).	W.	—	—	—	—	3 p.m. (12th).	W. by S.	7	Noon (12th).	W.	32	—

The southerly gale, as will be seen, set in at 4 p.m. at Falmouth, and was reported about 5 p.m. at Penzance. At Portsmouth the commencement was recorded at 8.40 p.m. At St. Ann's Head, near Milford, an E.S.E. gale began at 6 p.m., and at Roche's Point a gale from N.E. was felt from 9 p.m. to 3 a.m.

The lull in the wind which occurred at Falmouth when the direction of the wind shifted to N.W. was noticed by the observer at Penzance at 11.30 p.m., the observation therefore being exactly confirmed by the automatic record at Falmouth. At Portsmouth the shift of wind was reported at 4 a.m., when the force was stated to be that of "a hurricane."

It was, however, on the French coast, and at the Channel Islands, that the storm was most serious. The average hourly velocity registered by Dr. Hoskins in Guernsey was 68 miles between 9 p.m. on the 11th and 9 a.m. on the following morning, and in an account of the performance of an Osler's pressure-plate anemometer it is said, "From midnight to 4 a.m. a terrific hurricane raged from S.W., the anemometer "recording 40 to 45 lbs., 77 to 95 miles, culminating between 2 and 3 in the extra-"ordinary pressure of 45 to 55 lbs. on the square foot, a velocity of 100 to 105 miles "an hour."

Although we are without information as to the position, &c., of this anemometer, we see that its records agree on the whole with those given by Dr. Hoskins, and there can be no doubt that the storm was one of extraordinary violence. It is worth notice that the wind in the Channel Islands did not shift to N.W. at all.

We have no exact reports as to the passage of the gale over Holland and Germany on the morning of the 12th. In the afternoon of that day it reached Hamburg, and during the night, from 10 p.m. to 6 a.m., the velocity averaged 47 English miles an hour, the direction, as in the Channel Islands, being south-west.

Sept. 12. Fig. 50 shows us that the area of depression had advanced to the North Sea, and was oval in shape, lying along the east coast of England. Gradients to the northward and eastward were slight, but that from Rochefort to Yarmouth was as much as 10; and consequently heavy westerly and N.W. gales were reported at all the southern stations. The rainfall had been general, and had exceeded an inch at three stations. Plate CI. shows us that another rapid decrease of pressure set in during the afternoon of the 12th, which travelled with great rapidity and was very marked in its character. It is most unfortunate that the simultaneous failure of the barograms at Glasgow and Stonyhurst prevents our being able to trace this disturbance thoroughly. The gale which accompanied it was nearly as strictly confined to the southern stations as that of the previous night had been, as appears from the particulars which have been recorded of it.

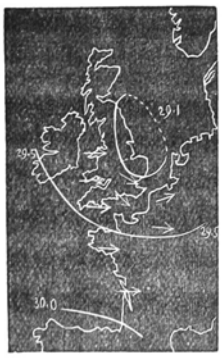

Fig. 50. Sept. 12.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	5 p.m. (12th).	S.	7 p.m. (12th).	S. veering to W.	51	14	Noon (13th)	W.	17	3 a.m. (13th).	W.S.W.	57	—
Falmouth -	11 p.m. (12th).	S.W. by S.	7 a.m. (13th).	W.	52	9	5 p.m. (13th)	W.	18	1 p.m. (13th).	W.	59	—
Holyhead -	10 p.m. (12th).	S.S.W.	11 p.m. (12th).	S.W.	49	6	5 p.m. (13th)	W.N.W.	20	1 a.m. (13th).	S.S.W.	50	—
Stonyhurst -	—	—	—	—	—	—	—	—	—	1–3 p.m. (13th).	W.N.W.	27	—
Kew -	8 a.m. (13th).	S.W.	—	—	—	—	3 p.m. (13th)	W. by S.	7	2 p.m. (13th).	W. by S.	38	—

In addition to these statements we may add that a N.W. gale of the force of 9 or 10 was reported from almost all the English telegraphic stations during the night. This wind was even felt at Liverpool and Scarborough (at which latter station it only lasted from midnight to 3 a.m.), although the anemograph at Stonyhurst was quite unaffected by it.

The only ships from which we have received accounts of this gale were the S.S. "Scotia," Capt. Judkins, and "City of Brooklyn," Capt. Brooks. Both these vessels experienced severe weather, with a wind of force 9 or 10 from S.W., veering to N.W., during the afternoon and night of the 12th, while they were off the south coast of Ireland.

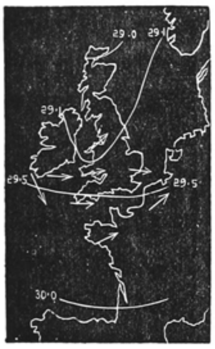

Fig. 51. Sept. 13.

Sept. 13. In Fig. 51 we see an extensive area of readings, ranging about 29·0 in., embracing Scotland and the north of England. The gradients for westerly winds are even higher than they were on the previous day, that from Rochefort to Pembroke being as much as 12. Consequently a heavy westerly gale is raging in the Channel and on the Irish coast, with a very high sea.

In the afternoon the barometer rose rapidly at all stations and the gale moderated, but this change was only temporary, for before midnight a fresh decrease had set in at Valencia, where the gale recommenced at 10 p.m. This disturbance was of much longer duration than either of the two which had preceded it, and the anemometrical records which have been obtained of it exhibit some very interesting peculiarities.

Observatories.	Velocity. 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	10 p.m. (13th).	S.E. by S.	2 a.m. (14th).	S.	52	7	Midnight (15th).	W.	50	8 a.m. (14th).	S. by W.	57	—
			Midnight (14th).	S.S.W.	41	13							
Armagh	—	—	—	—	—	—	—	—	—	9 p.m. (15th).	W.N.W.	28	—
Sandwick	1 p.m. (14th).	S.E. by E.	—	—	—	—	4 p.m. (14th)	S.E. by E.	3	3 p.m. (14th).	S.E. by E.	33	A strong breeze for a few hours, the wind being nearly dead calm for the whole of the 14th and 15th.
Falmouth	7 a.m. (14th).	S.W.	—	—	—	—	11 p.m. (14th)	S.W.	16	Noon (15th).	W.S.W.	42	The lull between the two storms was much more marked at Falmouth than at Valencia.
	8 a.m. (15th).	S.W.	10 a.m. (15th).	S.W. by W.	42	3	Noon (16th)	W. by N.	28				
Holyhead	4 a.m. (14th).	S.S.W.	11 a.m. (14th).	S.S.W.	42	4	4 p.m. (14th)	S.W.	12	2 p.m. (14th).	S.W. by S.	45	The sudden increase in the velocity at midday on the 14th and 15th is very remarkable.
	2 a.m. (15th).	S.W.	11 a.m. (15th).	S.W.	42	4	7 a.m. (16th).	W.N.W.	29	9–11 p.m. (15th).	S.W.	51	
			7 p.m. (15th).	S.W. by W.	49	8							
Stonyhurst	Midnight (15th).	S.W. by W.	—	—	—	—	4 a.m. (16th)	W. by N.	4	2 a.m. (16th).	W.S.W.	36	A perceptible freshening of the wind occurred at this station on both days nearly simultaneously with the temporary gale just noticed at Holyhead.
Kew	—	—	—	—	—	—	—	—	—	5 a.m. (16th).	S.W. by W.	30	This velocity was only registered for one hour, but the wind blew as a fresh breeze from S.W. for the two days.

This gale, too, was confined to the southern stations, not having been felt at all at the Scotch observatories; a fact which is the more noticeable because the barograms for Glasgow and Aberdeen (Plate CIII.) exhibit as remarkable an unsteadiness of pressure on the 14th as was registered at Valencia, and much more so than can be traced at Falmouth.

Sept. 14. The chart for this day, which has not been reproduced, shows at 8 a.m. a great bend in the isobars to the northward along the east coast of England, where the rise of the barometer had exceeded 0·6 in. This was due to the advance eastwards of the wave of high pressure shown on Plate CIII. The wind was for the most part moderate from S.W., except at Valencia, Holyhead, and Falmouth.

Sept. 15. The fall of the barometer having been greatest in the north and east, the isobars again ran from W.S.W. to E.N.E., the wind being generally westerly, blowing a moderate gale at the western stations, which passed up the English Channel in the course of the day, and finally reached Hamburg in the afternoon of the 16th.

The only point worthy of notice in the barograms is the peculiar oscillation which passed over Armagh and Stonyhurst, but was scarcely registered elsewhere, except at Glasgow and Kew. The times at which the minimum readings were respectively recorded, viz., Armagh, 9.30 p.m. 15th; Stonyhurst, 2 a.m. 16th; Kew, 5.30 a.m. 16th, were nearly exactly those of the maximum velocity of the wind as given in the table on p. 70.

Sept. 16. The depression had reached the coast of Norway, and a brisk recovery had set in at all British stations, the wind veering to W. and N.W. However, at noon the barometer began to fall again at Valencia, and the wind backed to E.S.E. and increased to a strong breeze from south for a few hours before midnight. This augmented velocity was not felt elsewhere except at Falmouth, where it occurred from 2 to 6 a.m. on the 17th, and at Holyhead from 4 to 8 a.m. It was, however, only the precursor of a more serious disturbance which speedily ensued; for the gale began again at Valencia at 2 a.m. on the 17th, and passed over all the stations in the course of that day and the next, but did not attain great violence anywhere, as the subjoined table shows.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	3 a.m. (17th).	S.S.W.	7 p.m. (17th). 2 a.m. (18th).	S. S. by W.	46 42	3 10	3 p.m. (18th).	S.W. by S.	36	10 p.m. (17th).	S.	49	At midnight on the 17th the velocity fell to 21 miles for two hours.
Armagh -	—	—	—	—	—	—	—	—	—	Noon (18th).	S.S.W.	27	—
Glasgow -	11 a.m. (18th).	S.	—	—	—	—	4 p.m. (18th).	S.	5	1 p.m. (18th).	S.	39	—

Observatories.	VELOCITY, 30–40 Miles per Hour.		VELOCITY, Exceeding 40 Miles per Hour.				VELOCITY Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	MAXIMUM VELOCITY.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Aberdeen -	—	—	—	—	—	—	—	—	—	5 p.m. (18th).	S.	24	—
Sandwick -	—	—	—	—	—	—	—	—	—	Noon (18th).	S.S.E.	24	—
Falmouth -	2 a.m. (18th).	S.S.W.	—	—	—	—	3 p.m. (18th).	S.S.W.	13	10 a.m. (18th).	S.S.W.	36	—
Holyhead -	1 p.m. (17th).	S.S.W.	2 a.m. (18th). 10 a.m. (18th).	S. S.S.W.	52 41	5 9	10 p.m. (18th).	S.W.	23	4 a.m. (18th).	S.	58	—
Stonyhurst -	4 a.m. (18th).	S.	—	—	—	—	6 a.m. (18th).	S.	2	5 a.m. (18th).	S.	32	—
Kew - -	10 a.m. (18th).	S.W. by S.	—	—	—	—	2 p.m. (18th).	S.S.W.	4	1 p.m. (18th).	S.W. by S.	33	—

Sept. 17. The chart for this day shows the approach of a fresh depression to the west coast of Scotland, which steadily advanced eastwards, so that fig. 52 for the 18th exhibits the isobars running from S.W. to N.E., with a difference of readings of about an inch between Wick and the south of France, and a general south-west gale sweeping along the Irish Channel and across the north of England, which extended to the Clyde by 10 a.m., and died down in the course of the evening.

Plate CV. shows a remarkable oscillation of pressure at the English observatories during the night of the 18th, which, however, did not affect the wind at all, excepting in so far as to cause a slight veer towards west at the time of passage of the minimum.

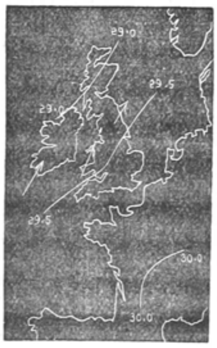

Fig. 52. Sept. 18.

Sept. 19. Fig. 53 exhibits a distribution of pressure not very dissimilar to that prevailing on the previous day, excepting that the lowest readings are below 29 in., and that the isobar of 28·9 takes a course which is slightly convex to the northward. The total difference of readings between the northern and southern stations is almost unaltered, but the local gradients have increased seriously, that from Holyhead to Greencastle being as much as 13. Consequently the gale, which had recommenced at midnight at Holyhead, was principally confined to the district lying between Wales and the Grampians.

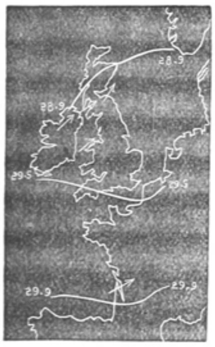

Fig. 53. Sept. 19.

Temperature had decreased at most stations, and a most striking change is noticeable in the dryness of the air, the tension of aqueous vapour having been reduced to the extent of more than a tenth of an inch at every station except Valencia and Greencastle.

The following table gives the particulars of this gale as recorded at the observatories :—

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind,	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	8 a.m. (19th).	W.	—	—	—	—	11 a.m.(19th).	W.	3	10 a.m. (19th).	W.	32	—
Armagh -	—	—	—	—	—	—	—	—	—	Noon (19th).	S.W.byW.	39	This velocity was only attained for one hour.
Glasgow -	7 a.m. (19th).	S.W. by S.	11 a.m. (19th).	S.W.	42	6	6 p.m. (19th).	W.N.W.	11	3 p.m. (19th).	W.S.W.	48	—
Aberdeen -	—	—	—	—	—	—	—	—	—	3 a.m. (20th).	N.W.byN.	32	This velocity only lasted for one hour.
Sandwick -	1 a.m. (20th).	N.W.	—	—	—	—	4 a.m. (20th).	N.W.	3	2 a.m. (20th).	N.W.	33	—
Falmouth -	1 p.m. (19th).	W. by N.	—	—	—	—	5 p.m. (19th).	W. by N.	4	3 p.m. (19th).	W. by N.	36	—
Holyhead -	1 a.m. (19th).	W.N.W.	9 a.m. (19th).	S.W.	46	10	5 a.m. (20th).	W.N.W.	28	2 p.m. (19th).	W.S.W.	47	—
Stonyhurst -	11 a.m. (19th).	W.S.W.	—	—	—	—	1 a.m. (20th).	W.	13	9 p.m. (19th).	W. by S.	39	—
Kew -	—	—	—	—	—	—	—	—	—	3 p.m. (19th).	W. by S.	23	—

Capt. W. H. Smith of the s.s. "Hibernian," outward bound from Liverpool by the North Channel, met this gale off the north coast of Ireland. He does not report a stronger force of wind than 8. His barometer, however, fell very low, the reading at 8.45 a.m. on the 18th being 28·589. The position of the ship at the time was in lat. 55° 40′ N., long. 10° 47′ W., about midway between Rockall and the Irish coast.

It will be noticed on Plate CV. that in the course of the day a marked barometrical hollow passed over the Scotch observatories, which is also traceable, though in a less degree, at Stonyhurst. The wind at Glasgow rose to a gale during the passage of the depression, but the anemograph at Aberdeen was hardly affected by it, if we except the fact that the vane suddenly veered from S. to N.W. at the time when pressure began to recover again. The worst part of this gale passed off across the North Sea in an E.S.E. direction, for while it was not felt at Skudesnaes or the other western Norwegian stations, a heavy gale from S.W. veering to W. was reported at Mandal and Sandosund during the 19th, and at Hamburg from noon on the 19th to the afternoon of the next day, while at Bodö and Vardö, in the extreme north of Norway, moderate easterly gales were felt on the same days.

Sept. 20. The barometrical depression noticed in our barograms for the 18th and 19th seems to have been more serious in higher latitudes than with us, possibly its trajectory lay clear outside the coast of Scotland. At all events this morning the reading at Hernosand is as low as 28·43 in., while a brisk rise of the mercury is reported over these islands, and amounts to 0·55 in. at Greencastle. A considerable decrease is, however, noticed at Corunna and Biarritz, affecting also the other stations on the west coast of France, and being traceable in the barogram for Falmouth. The wind in the United Kingdom is generally light to moderate from N.W., but at the entrance of the Channel it has veered to S.E. In the afternoon it increased to a fresh gale from S. at Biarritz, where the barometer had fallen quickly between 8 a.m. and 2 p.m.

Sept. 21. There was little to note over the British Isles, where the barometer rose steadily; however, at the southern stations a very rapid recovery of pressure is observed, and northerly gales were reported to have been felt in Brittany, while heavy storms from west were announced from Rochefort and Biarritz, and from north-west on the south coast of France. At Leghorn and Florence, to which stations the depression had advanced, the gale was south-westerly.

Sept. 22. The effect of the extensive rise of pressure in the west of Europe had been to increase the gradients for westerly winds over Norway, and accordingly a strong gale from west was reported both at Christiansund and Aalesund, which lasted throughout the day.

At our own stations a sudden fall of the barometer appears about noon (Plate CV.), but is confined to the four northern observatories. It caused the wind to freshen to a moderate gale at Valencia, Holyhead, and Glasgow.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	7 a.m. (22nd).	S.S.W.	11 a.m. (22nd).	S.S.W.	41	5	6 a.m. (23rd)	S. by W.	23	1 p.m. (22nd).	S.W. by S.	42	—
Glasgow -	8 p.m. (22nd).	S.W. by W.	--	—	—	—	5 a.m. (23rd)	W.S.W.	9	9 p.m. (22nd).	S.W. by W.	40	—
Holyhead -	11 a.m. (22nd).	S.W. by S.	2 p.m. (22nd).	S.W. by S.	40	2	9 a.m. (23rd)	S.W.	22	2-4 p.m. (22nd).	S.W. by W.	40	—

This disturbance was not felt at any other station except Armagh and Stonyhurst, where the velocity of 30 miles was reached for one hour in either case. There was but little to remark during the next two days. Winds were generally westerly, with misty and wet weather, and a very thick fog on the south-west coast.

Sept. 25. A rapid fall is noticed in the Valencia barogram, which extended during the day to all the other stations, being very marked at Aberdeen, but much less noticeable in the south of England than elsewhere. The wind, which had already begun to blow hard at Holyhead and Valencia, had increased to a gale at those stations at 8 a.m., and the disturbance subsequently advanced to all the stations except those in the south of England.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 p.m. (24th).	S.S.E.	1 a.m. (25th).	S.	45	8	5 p.m. (25th).	S.W. by W.	18	6 a.m. (25th).	S.	51	—
Armagh -	3 p.m. (25th).	S.W.	—	—	—	—	6 p.m. (25th).	S.W.	3	5 p.m. (25th).	S.W.	35	—
Glasgow -	9 a.m. (25th).	S. by W.	—	—	—	—	10 a.m. (26th).	W. by S.	25	Midnight (25th).	S.W.	39	—
Aberdeen -	Noon (25th).	S.W. by S.	—	—	—	—	3 p.m. (25th).	S.W. by S.	3	1 p.m. (25th).	S.W. by S.	34	—
Sandwick -	11 p.m. (25th).	S.W.	3 a.m. (26th).	W.S.W.	40	8	6 p.m. (26th).	W. by N.	19	4 a.m. (26th).	W.S.W.	44	—
Holyhead -	2 p.m. (24th).	S.S.W.	6 a.m. (25th).	S.S.W.	41	12	3 p.m. (26th).	S.W.	49	7 a.m. (25th).	S.	46	—
Stonyhurst -	10 a.m. (26th).	W. by S.	—	—	—	—	Noon (26th).	W. by S.	2	11 a.m. (26th).	W. by S.	32	—

It will be seen from the table that the actual force of the gale was almost entirely confined to Valencia, Holyhead, Glasgow, and Sandwick. It also blew very hard at Nairn. The contrast between the velocities registered at Holyhead and Stonyhurst is very striking, the number of miles recorded at the former station during the 48 hours succeeding noon on the 24th being 1,781, while at the latter the record shows almost exactly half that amount, viz., 893 miles.

Sept. 26. The depression had advanced to the coast of Norway, where the fall had amounted to 0·8 in. at Christiansund. Heavy south-westerly gales set in at Skudesnaes and Mandal, which lasted throughout the day. In these islands the barometer rose at all stations, the change in Scotland commencing at 8 a.m., and being very rapid.

Sept. 27. Barometrical readings were remarkably uniform, and winds very light, with fine weather until the evening, when the barogram at Valencia shows a sudden fall, and very heavy rain set in, which amounted to 1·498 in. by 10 a.m. next morning.

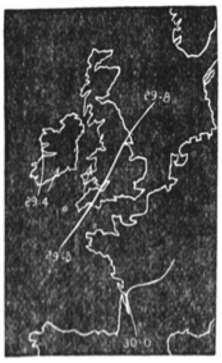

Fig. 54. Sept. 28.

Sept. 28. The reduction of pressure having made rapid progress during the night in the south of Ireland, fig. 54 exhibits the isobar of 29·4 just touching the Irish coast. The gradient from Penzance to Valencia is 8·5, and so we find that a southerly gale has already set in at the entrance of St. George's Channel.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Falmouth -	8 a.m. (28th).	S.S.W.	—	—	—	—	Midnight (28th).	S.	16	1–3 p.m. (28th).	S. by W.	34	—
Holyhead -	10 a.m. (28th).	S. by W.	11 a.m. (28th).	S.	47	16	5 a.m. (29th)	S. by E.	19	4 p.m. (29th).	S.	57	—

At Valencja the velocity rose to 32 miles an hour from south at 5 a.m., and to 50 at 9 a.m., when the instrument got out of order. At Stonyhurst the maximum velocity recorded was 25 miles an hour at 4 p.m., being not quite half what was registered at Holyhead.

This gale was very local; however, it blew pretty hard at Holyhead in the afternoon. The depression advanced in a south-easterly direction, the barometer in the west of France falling rapidly, while the wind at our western stations backed to S.E., and in the north of Scotland even to N.E.

Fig. 55 for the 29th shows the area of depression close to Cape Clear; but no actual gale is blowing, though the weather is squally and very wet. At Sandwick, however, a strong breeze from N.E. was felt throughout the day.

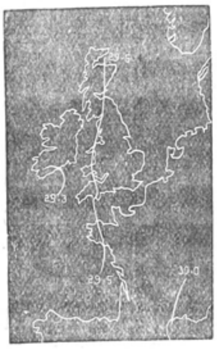

Fig. 55. Sept. 29.

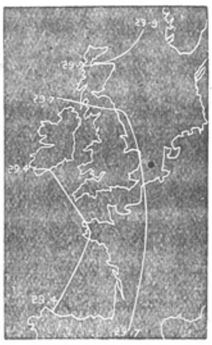

Fig. 56. Sept. 30.

Sept. 30. A brisk rise had set in in Scotland, while pressure was not much changed in the south-west, so that we see (fig. 56) that the curve of 29·4 takes a course from Corunna by Brest to Cork. Winds are generally sweeping round the area of depression, and are moderate to fresh in force, while heavy rain continues, with thunder and lightning over the Irish Sea.

REMARKS.

Wind.—The following table shows the number of hours during which the wind attained the velocity of 30 miles or upwards per hour, irrespective of its direction, during the entire quarter.

Observatory.	July.	Aug.	Sept.	Total.	Observatory.	July.	Aug.	Sept.	Total.
Valencia - -	74	1	211	286	Falmouth - -	12	22	156	190
Armagh - -	0	0	6	6	Holyhead - -	—	—	278	—
Glasgow - -	12	2	56	70	Stonyhurst -	0	0	26	26
Aberdeen - -	2	9	8	19	Kew - - -	0	0	24	24
Sandwick - -	36	43	59	138					

It will be seen from a comparison of this table with the preceding ones of a similar nature, pp. 31 and 57, that there was on the whole more high wind than in the second quarter, though still much less than in the first three months of the year. At Aberdeen, however, the period was remarkably calm.

As might have been anticipated from the observations on p. vii. of the Introduction, the addition of Holyhead to the number of our stations gives a totally different appearance to the table to what it had previously. The number of hours during which high velocities were registered at that station in September far exceeds even that reported from Valencia, while it is more than ten times as great as the figure given for Stonyhurst, a station distant only 95 miles from it.

*Pressure.**—

July.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·036	—	30·435	14th, 9 a.m.	29·577	25th, 4 p.m.	0·858
Armagh - -	29·991	+0·076	30·372	10th, 3 p.m.	29·540	29th, 3 p.m.	0·832
Glasgow - -	29·973	+0·101	30·394	10th, 10 p.m.	29·554	29th, 7 p.m.	0·840
Aberdeen - -	29·944	+0·066	30·357	11th, 5 a.m.	29·487	6th, 6 a.m.	0·870
Falmouth - -	30·115	+0·067	30·587	10th, noon.	29·712	26th, 4 a.m.	0·875
Stonyhurst - -	30·047	+0·137	30·445	10th, 10 p.m.	29·691	6th, 2 a.m.	0·754
Kew - - -	30·098	+0·114	30·435	10th, 10 a.m.	29·790	26th, 5 p.m.	0·645

Pressure was in excess during the month, especially at Stonyhurst, owing to the prevalence of fine weather. The range was comparatively slight, as it did not amount to 0·9 in. anywhere. It was greatest at Falmouth, where also the maximum reading was noticed. The lowest reading was recorded at Aberdeen. The maximum was noticed everywhere, except at Valencia, during the passage of the wave of high pressure on the 10th and 11th, shown on Plate LXXVII.

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* For an explanation of these tables, see Part I. pp. 31 et seq.

August.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·218	—	*30·494	16th, 10 p.m.	29·664	3rd, 7 a.m.	0·830
Armagh - -	30·181	+0·317	*30·512	31st, midngt.	29·590	9th, 8 a.m.	0·922
Glasgow - -	30·123	+0·306	*30·451	31st, midngt.	29·519	9th, noon.	0·932
Aberdeen - -	30·060	+0·236	*30·430	27th, 11 a.m.	29·436	9th, 3 p.m.	0·994
Falmouth - -	30·206	+0·191	30·443	15th, 9 p.m.	29·810	9th, 10 a.m.	0·633
Stonyhurst - -	30·154	+0·269	*30·441	17th, 8 a.m.	29·528	9th, 10 a.m.	0·913
Kew - - -	30·161	+0·205	*30·414	18th, 5 a.m.	29·578	9th, 4 p.m.	0·836

* These values differ from those given in Table I. (Part I.), as civil time being used here, the values given in that table would fall in September.

Barometrical readings are again in excess, and considerably so. The continuance of fine weather for the greater part of the month kept the range within moderate limits in August as in July, for at Aberdeen, where its extent was greatest, it did not amount to an inch. The highest reading was recorded at Armagh, and the lowest at Aberdeen. All the minima were recorded on the 9th except at Valencia.

September.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	29·671	—	30·554	1st, 9 p.m.	29·088	13th, 2 a.m.	1·466
Armagh - -	29·619	−0·232	30·673	1st, 9 p.m.	28·945	13th, 4 a.m.	1·728
Glasgow - -	29·603	−0·199	30·510	1st, 11 a.m.	28·713	19th, 3 p.m.	1·797
Aberdeen - -	29·565	−0·247	30·480	1st, noon.	28·677	19th, 4 p.m.	1·803
Falmouth - -	29·819	−0·191	30·450	1st, midngt.	28·670	11th, 11 p.m.	1·780
Stonyhurst -	29·687	−0·219	30·490	1st, 9 p.m.	28·986	12th, 5 a.m.	1·504
Kew - -	29·811	−0·163	30·446	1st, 9 a.m.	28·751	12th, 5 a.m.	1·695

In September the excess of pressure which had existed for three months gave way to a considerable defect, which was greatest at Aberdeen. The range assumed the proportions which it had exhibited during the early months of the year, exceeding 1·8 in. at Aberdeen. The highest readings were registered at all the stations during the afternoon of the 1st, the absolute maximum being noticed at Armagh. The minimum was recorded at Falmouth during the remarkable depression of the 11th, described at p. 67.

Temperature.—

July.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	61·4	—	77·9	16th, 3 p.m.	50·7	27th, 5 a.m.	27·2
Armagh - -	61·5	—	78·1	17th, 4 p.m.	47·7	20th, 5 a.m.	30·4
Glasgow - -	59·4	+2·6	79·0	17th, 3 p.m.	44·7	28th, 4 a.m.	34·3
Aberdeen - -	58·5	+2·6	74·0	21st, noon.	47·0	29th, 5 a.m.	27·0
Falmouth - -	61·6	—	78·4	18th, 2 p.m.	51·8	10th, 4 a.m.	26·6
Stonyhurst - -	61·2	+3·4	80·5	17th, 2 p.m.	43·8	28th, 5 a.m.	36·7
Kew - - -	64·6	+3·1	88·3	22nd, 2 p.m.	48·7	29th, 4 a.m.	39·6

Temperature again rose slightly above the average in July, having been below it during the two preceding months. The highest temperature, as well as the greatest range, is reported from Kew; the lowest temperature from Stonyhurst.

August.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	59·9	—	82·3	27th, 3 p.m.	*49·1	31st, 6 a.m.	33·2
Armagh - -	57·7	—	77·4	27th, 4 p.m.	38·3	30th, 6 a.m.	39.1
Glasgow - -	56·1	−1·0	76·1	28th, 2 p.m.	35·0	30th, 5 a.m.	41·1
Aberdeen - -	55·4	−0·6	78·3	25th, 2 p.m.	39·2	30th, 2 a.m.	39·1
Falmouth - -	60·9	—	73·8	26th, 3 p.m.	48·9	31st, 5 a.m.	24·9
Stonyhurst - -	57·7	+0·5	83·2	28th, 3 p.m.	36·8	31st, 6 a.m.	46·4
Kew - - -	60·6	−0·2	86·6	28th, 2 p.m.	*44·2	31st, 6 a.m.	42·4

* These values differ from those given in Table I. (Part I.), as civil time being used here, the values given in that Table would fall in September.

In August the temperature scarcely varied from its average value. The columns for the extreme readings and for the range present some features of marked interest, to which allusion has already been made (p. 64). At all the observatories the maximum and minimum readings respectively were registered during the last six days of the month, and at four of the observatories within three days of each other. At Glasgow the interval which elapsed was only 39 hours.

The maximum temperature was observed at Kew, the minimum at Glasgow, and the greatest range at Stonyhurst.

September.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	57·2	—	68·4	4th, 2 p.m.	45·6	12th, 5 a.m.	22·8
Armagh - -	55·3	—	68·7	9th, 2 p.m.	44·0	20th, 7 a.m.	24·7
Glasgow - -	54·6	+1·3	66·4	9th, 1 p.m.	39·3	3rd, 5 a.m.	27·1
Aberdeen - -	53·7	+1·1	66·8	7th, 3 p.m.	40·9	27th, 6 a.m.	25·9
Falmouth - -	58·0	—	68·2	7th, 1 p.m.	50·5	12th, 6 a.m.	17·7
Stonyhurst - -	55·9	+2·0	68·8	5th, 2 p.m.	44·3	22nd, 5 a.m.	24·5
Kew - - -	59·1	+2·8	77·2	5th, 2 p.m.	40·5	1st, 5 a.m.	36·7

In September the temperature was slightly above the average. The range fell within more moderate limits than it had exhibited during the preceding quarter. As usual it was greatest at Kew, where also the extreme readings were recorded.

The comparison of the five-day means for Kew with those given by Dove for Greenwich gives the following results: —

Dates.	Variation.	Dates.	Variation.	Dates.	Variation.
	°		°		°
June 30–July 4	− 2·5	July 30–Aug. 3	− 0·3	Aug. 29–Sept. 2	−5·3
July 5– 9 -	+ 2·1	Aug. 4– 8 -	− 1·3	Sept. 3–7 -	+4·1
„ 10–14 -	+ 3·3	„ 9–13 -	− 3·9	„ 8–12 -	+3·0
„ 15–19 -	+ 7·4	„ 14–18 -	− 1·5	„ 13–17 -	+2·3
„ 20–24 -	+ 4·3	„ 19–23 -	− 0·6	„ 18–22 -	−0·2
„ 25–29 -	+ 0·1	„ 24–28 -	+ 8·9	„ 23–27 -	+4·3

The cold period which had prevailed through May and June came to an end on the 4th of July, and the rest of the month was warmer than usual. The first five five-day means for August show a slight defect in temperature, but the mean for the 24th—28th is nearly 9° above the average, while the very next mean is more than 5° too low. From this to the end of the quarter there was not much to notice.

The contrast between the two means at the end of August is very striking. It will be remembered that this was the period of the sudden fall of the thermometer at all our stations.

PART 4.

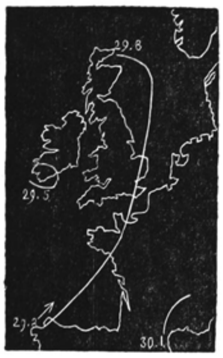

Fig. 57. Oct. 1.

Oct. 1st. Fig. 57 exhibits the depression, which was noticed on the previous day (p. 76) as existing outside our south-west coast, situated off the south coast of Ireland. It is much reduced in area, and the actual reading at its centre is 0·1 higher than on the 30th. Over the French stations, however, the rise of the barometer has been more considerable, so that the gradients for south-west winds have increased over the Bay of Biscay, and a stiff gale from that point is reported from Corunna. The winds were generally fresh from south on the west coast of France, but at our stations they did not attain any great force, except at Penzance, where a gale from S.S.E. was reported from 7 p.m to 3 a.m. on the 2nd. This increase of wind was evidently due to the advance of the depression across the entrance of the channel to Brest, where we find it at 8 a.m. on the 2nd, while the S.W. gales have reached L'Orient and Rochefort. Elsewhere winds are very light. Weather has been overcast and showery.

A brisk increase of pressure is noticeable in the south-west next morning, while the centre of depression has moved eastwards to Holland, where it apparently died out during the day, the weather becoming finer, with light easterly winds in the north of England.

Oct. 4. Although the barograms for this day show scarcely a sign of a disturbance, the wind at Valencia had backed gradually to E., and at 10 p.m. it freshened to the velocity of 30 miles an hour from S.E., and maintained it for 37 hours, even reaching that of 40 miles for 5 hours on the evening of the 5th.

This breeze was not felt at any other observator except at Falmouth, where it was recorded for a few hours about noon on the 6th.

Winds were generally very light from S. and W. at our northern stations, while over France a moderate easterly breeze was prevalent. Dense fog was reported from the northern stations, and from the south coast of Ireland on the night of the 5th, and continued at several stations during the next few days. Weather was otherwise fine and very warm for the season. The maximum temperature for the month was recorded on the 9th or 10th at all the observatories except Aberdeen, and it exceeded 70° at three of the stations; otherwise there was nothing of importance to report.

Oct. 10. The wind at Valencia again increased to the force of a strong breeze from S.E. during the daytime, which died down at night, when the direction veered to S.W. On this day a slight depression passed over the north of Norway.

At noon on the 11th the vane at Valencia was again at S.S.E., and a strong breeze from that point was felt up to 5 a.m. on the 12th. This wind was not felt on our other coasts except in the Irish Sea, where a similar breeze was registered at Holyhead during the 12th and 13th. At Ardrossan also a S.W. gale was reported at 2 a.m. on the 12th. These winds were apparently caused by a barometrical depression which was either in existence, or in process of formation, over the Atlantic to the north-west of Scotland. In a careful discussion of the weather of the next few days, which, as we shall see, were marked by very serious storms in Norway, and which was published by Professor Hildebrandsson of Upsala,* it is assumed that there was an actual depression on the 11th, with its centre near the Faroe Islands. It hardly appears from the British observations that there is sufficient evidence for so definite a statement. At our own stations the barometer was remarkably steady up to the evening of the 11th, when a decrease set in which is noticeable in the barogram from Aberdeen, and which amounted to 0·2 ins. at Sandwick and at Christiansund in Norway by 8 a.m. next morning.

Oct. 12. Plate CXIII. shows us that pressure was falling unsteadily during the day at Aberdeen, and a very slight depression passed over that station at midnight, and over Armagh and Glasgow shortly afterwards. On the coast of Norway, however, the disturbance was much more serious, and the barometer at Christiansund fell steadily during the day. At night the rate of decrease became more rapid, and at 8 a.m. on the 13th the centre of the depression was situated to the north-west of that station. It rapidly approached the coast during the day, and by 8 p.m. when the minimum reading was registered at Christiansund, the fall of the mercury since 8 p.m. on the 12th had amounted to 0·68 in. The effect of this disturbance was to cause serious gales from S.W. veering to N.W. and N.N.W. at all the Norwegian stations in the course of the 13th and 14th. None of our own observatories felt the storm except Sandwick, where, however, it was severe, the wind averaging a velocity of 50 miles an hour for 36 hours from midnight on the 12th. At Wick and Ardrossan also a N.W. gale was reported on the 13th.

The most remarkable effect of this change of wind which was experienced at our stations was the great reduction of temperature which accompanied it, and which exceeded 20° at Nairn between the 12th and 13th. Plate CXV. shows that it affected all the thermograms except that at Valencia, where, as well as at the other south-western stations, thick fog was reported. The chill was very sudden at the Scotch observatories, and it did not extend to those in the south of England until the 14th. The diminution of vapour tension was also very striking, exceeding two tenths of an inch in the north.

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* Stormarna den 13de—21sta Oktober 1869, af H. H. Hildebrandson, Upsala, 1870.

Oct. 14. The centre of the depression just noticed was near Bodö, which station it passed about noon. Professor Hildebrandsson gives a chart for this day which shows that gradients were steep for westerly winds over the south of Scandinavia, where strong gales were felt. Over these islands generally a rise of pressure was observed with moderate north-westerly winds. During the afternoon the barometer began to fall briskly at all the stations, while the wind backed to the westward.

Oct. 15. We find the centre of the depression, whose course we have just been tracing, not far from Torneå, while in these islands the reduction of pressure made further progress, the fall up to 8 a.m. being greater on the north coast of Ireland than elsewhere. There was on the whole but little sign of a serious disturbance. Temperature was 19° lower at the northern stations than in the Channel. The distribution of vapour, however, showed that the atmosphere was in an unsettled condition, for while its tension remained low in the north of Scotland, a rapid increase, exceeding 0·1 in. since the previous morning, is noticeable at Greencastle and Ardrossan. The wind was generally westerly, fresh in the south of Ireland, but very light over Scotland. Up to the afternoon there was still nothing to excite immediate alarm; the fall of the barometer had continued, but was most rapid at Nairn, where the wind shifted to E.N.E., still remaining very light. At Holyhead, however, a strong breeze from S.W. began to blow at noon, and before night a slight S.W. gale set in at Valencia also. At Sandwick the easterly winds freshened considerably at midnight, while at Aberdeen a hard gale from E. sprung up suddenly at 5 a.m.

Oct. 16. We see from Fig. 58 that an area with readings below 29·2 in. lay over the south of Scotland, and the wind was circulating round it, blowing with the force of a gale from N.W. in the south of Ireland, from S.W. over Brittany, and from N.E. in the north of Scotland. It seems very hard to account for the suddenness and force of this gale, especially the easterly portion of it. The French observations show that the decrease of pressure was very general over western Europe, and it amounted to more than half an inch at several of our stations, and on looking to Professor Hildebrandsson's chart, we find that the only Scandinavian stations which reported a rise of the barometer were those in the south-west of Sweden, where the change did not amount to more than 0·2 in., so that we cannot see from what region the supply of polar air was derived. A moderate easterly breeze prevailed at Skudesnaes and Mandal all day long

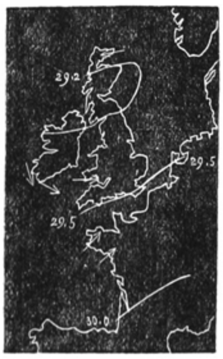

Fig. 58. Oct. 16.

on the 16th, but it seems quite inadequate to account for the force of wind observed at our Scottish stations.

Plate CXV. shows us that a well-marked depression passed over all the observatories in the course of the day, producing the lowest barometrical reading for the month at each station, the barometer rising rapidly after the minimum reading was reached, especially in the west. It would seem, judging by the anemograms, Plate CXVI., that the centre of the storm passed across Scotland not far south of Aberdeen. The direction trace proves that at Aberdeen the vane flew to S.E. at 5 a.m., and then backed steadily to N. and N.W., whereas at Glasgow the extreme limit of the oscillation was to N.N.E., and at the southern stations the wind never shifted as far as North at all. The instrumental records which have been preserved of the force of the gale are as follows:—

Observatories.	VELOCITY. 30-40 Miles per Hour.		VELOCITY. Exceeding 40 Miles per Hour.				VELOCITY. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	MAXIMUM VELOCITY.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	5 p.m. (15th).	S.W. by W.	1 p.m. (16th).	N.N.W.	42	3	8 p.m. (16th).	N.N.W.	27	3 p.m. 16th).	N.N.W.	43	—
Glasgow	1 p.m. (16th).	N.	—	—	—	—	8 p.m. (16th).	N. by W.	7	7 p.m. (16th).	N. by W.	40	—
Aberdeen	5 a.m. (16th).	E.	5 a.m. (16th).	E. backing to N.N.E.	53	10	4 p.m. (16th).	N.N.E.	11	9 a.m. (16th).	E.	60	—
Sandwick	Midngt. (15th).	E.N.E.	2 p.m. (16th).	N. by W.	43	19	3 p.m. (17th).	N.W.	39	2 a.m. (17th).	N.N.W.	55	—
Falmouth	Noon (16th).	W. by S.	—	—	—	—	1 a.m. (17th).	N.W.	13	1 p.m. (16th).	W. by S.	38	—
Holyhead	Noon (15th).	S.W.	2 p.m. (16th).	N. by W.	50	22	3 p.m. (17th).	N.W.	51	7 p.m. (16th).	N. by E.	73	—

The gale was not felt at any of the three inland observatories, and at Yarmouth, as registered by the anemograph, the wind only reached the force of a strong breeze from W.N.W. for a few hours on the 16th and 17th.

From this table it appears that this storm was very remarkable in its character, being much more serious in the north of Great Britain than elsewhere. At Aberdeen, though it only lasted for 11 hours, the average hourly velocity during 10 of those hours was 53 miles. At Holyhead, as usual, there was an excess of northerly wind, and the high velocity of 73 miles was attained at 7 p.m. on the 16th. During the night the force of 10 or 11 (Beaufort scale) was reported from almost all the telegraphic stations except those on the Channel coast. At Scarbro' the violence of the gale was greatest about 10 p.m., and at Bridlington the velocity of 40 miles an hour was recorded from midnight to 6 a.m. by an anemograph erected by Capt. Barnes.

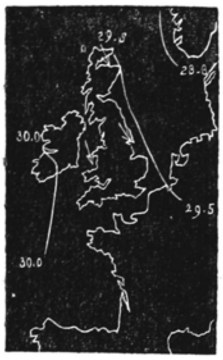

Fig. 59. Oct. 17.

Oct. 17. The depression had advanced eastwards across the North Sea, its centre passing south of Skudesnaes, where the wind, as at Aberdeen, had been easterly during the 16th. At 8 a.m. the lowest reading was reported at Mandal, and Professor Hildebrandsson places the actual centre over the Skagerack at that hour, with a reading of 28·5 in. (Fig. 59) for our own reports shows a total difference of pressure of 1·3 in. between Valencia and Skudesnaes, giving a gradient of 9·3 between those places. Accordingly the wind was north-westerly over these islands and the north of France, blowing with the force of a gale at several stations.

At Hamburg a S.W. gale had blown all through the night, and had advanced to the south coast of Sweden by 8 a.m., where its violence throughout the day was very serious.

Professor Hildebrandsson says, "In the course of the forenoon the centre travelled
" quickly across Sweden, and at 2 p.m. was situated in the district of Gefle. At
" Umeå the barometer fell 0·57 in. in 6 hours from 8 a.m. to 2 p.m., and the wind,
" which in the morning was light in this neighbourhood, increased to a full gale from
" the eastward. In the afternoon the centre moved northwards, and at 9 p.m. was at
" Umeå. The storm at this time raged over the entire of the Scandinavian peninsula.
" It blew from N.E. at Piteå, from E. at Bodö, from N. to N.W. Ostersund, Fahlun,
" and the Norwegian stations, from W. in the Cattegat, and from S.W. to S. over the
" Baltic. The gale was most violent in the north of the Gulf of Bothnia."

Rain was general in these islands, with hail and snow in the north and west. In the evening a brilliant lunar halo was seen in the north of England, with the rare phenomenon of paraselenæ. A notice of this occurrence, with a sketch of the appearance observed at Whitby, is given by the Rev. F. W. Stow in Symons' Meteorological Magazine, vol. iv. p. 145.

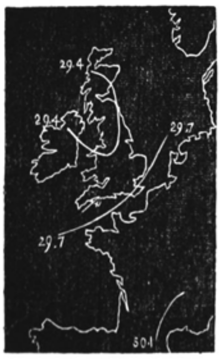

Fig. 60. Oct. 18, 8 a.m.

Plate CXV. shows us that the barometer began to fall again very briskly at the western and north-western stations on the evening of the 17th, and by next morning (see Fig. 60) the distribution of pressure bore a close resemblance to that represented on Fig. 58 for the 16th. This new disturbance, however, took a much more southerly course than that of its predecessor. The barograms, Plate CXVII., show some very remarkable conditions of pressure. It appears from them that the minimum had been reached almost simultaneously at 7 a.m. on the 18th at the four north-western stations, Valencia, Armagh, Glasgow, and Aberdeen. At this time the wind was sweeping in a cyclonic course round the district lying about Glasgow, at which station the wind at 6.30 a.m. had lulled and shifted suddenly from south to north-east, so that the centre of the storm probably passed close by. Fig. 60, as before said, shows us the course of the isobars at 8 a.m., while strong winds from between south-west and north-west were blowing at the south-western stations. Captain Smith in the "Hibernian" in lat. 56° N., and Mr. Greenwood in the "Scotia" on the parallel of Cape Clear, report stiff northerly gales off the west coast of Ireland, while in Caithness the wind was fresh from the eastward.

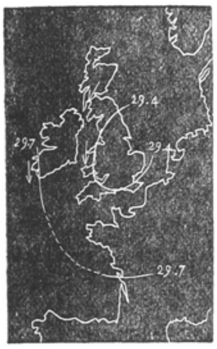

Fig. 61. Oct. 18, 6 p.m.

At 3 p.m. the minimum reached Stonyhurst, where, as at Glasgow, we notice the shift of wind from south to north-east and the decrease of its force. This would seem to show that the centre of the storm had advanced from Glasgow to near Stonyhurst, a view which is amply confirmed by Fig. 61 for 6 p.m., where we see the centre situated near Hull. The minimum readings were recorded respectively at Falmouth at 4 p.m. and at Kew at 6 p.m. It will be noticed that the barograms exhibit a remarkable flatness at the time of occurrence of the minimum reading at the three southern stations and at Armagh. At Kew this appearance is especially striking and the mercury remained steady at its minimum reading from 6 p.m. to 8 a.m. The records of a Milne barograph, registering every hour, which had been erected by this office at the Sailors' Home at Yarmouth at the beginning of the month, afford a contrast to the steadiness of the pressure at Kew, for the hourly dots show a steady fall of the mercury up to 9 a.m. on the 19th, when a rapid rise set in.

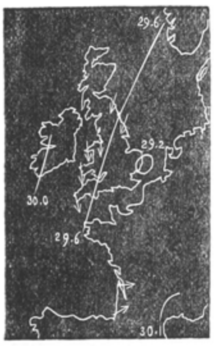

Fig. 62. Oct. 19, 8 a.m.

Oct. 19. Fig. 62 exhibits the depression situated close to Yarmouth, while the gradient from Ardrossan to that station is as much as 12. A very rapid recovery of pressure having occurred in the north-west, heavy northerly gales were blowing on the north-east coast of England and in the Irish Sea, accompanied by snow and hail showers. The observatory records which have been preserved of this disturbance are as follows :—

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	2 p.m. (18th).	N. W.	—	—	—	—	11 p.m. (18th)	N.N.W.	9	5 p.m. (18th).	N.W. by N.	34	—
Armagh -	—	—	—	—	—	—	—	—	—	9 p.m. (18th).	N.	16	—
Glasgow -	5 p.m. (18th).	N.N.E.	—	—	—	—	7 p.m. (18th)	N.N.E.	2	5-7 p.m. (18th).	N.N.E.	32	At noon on the 19th the wind again reached the velocity of 30 miles from N.N.W.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Aberdeen -	2 p.m. (18th).	E.N.E.	—	—	—	—	4 p.m. (18th)	N.E. by E.	2	3 p.m. (18th).	N.E. by E.	37	—
Sandwick -	1 a.m. (19th).	N. by W.	—	—	—	—	4 a.m. (19th)	N.N.W.	3	3 a.m. (19th).	N.N.W.	30	—
Falmouth -	1 a.m. (19th).	N.W. by N.	—	—	—	—	5 p.m. (19th)	N. by W.	16	6 a.m. (19th).	N.N.W.	38	—
Holyhead -	1 p.m. (18th).	N.N.W.	8 p.m. (18th).	N. by E.	53	27	3 a.m. (20th)	N.N.E.	38	2 a.m. (19th).	N.N.E.	63	—
Stonyhurst -	10 a.m. (19th).	N.	—	—	—	—	Noon (19th)	N. by W.	2	11 a.m. (19th).	N.	31	—
Kew - -	—	—	—	—	—	—	—	—	—	2 p.m. (19th).	N. by W.	30	This velocity was only reached for one hour.
Yarmouth -	10 a.m. (19th).	N.N.W.	—	—	—	—	8 p.m. (19th)	N.W.	10	11 a.m. (19th).	N.N.W.	35	—
Bridlington -	Midngt. (18th).	N. by E.	1 a.m. (19th).	N. by E.	51	9	Noon (19th)	N. by E.	12	6 a.m. (19th).	N.N.E.	58	—

It will be observed that this table exhibits no trace of a severe storm except at Holyhead and Bridlington, and yet we learn from the Board of Trade Wreck Register that this gale was the " most serious " to shipping during the entire year, as many as 28 casualties having occurred between the 18th and 20th, of which 17 were total wrecks. This fact is undoubtedly due to the suddenness of the storm, as evidenced by the Bridlington anemograph, and also to its being principally felt on the south-east coast of England. Almost all the vessels wrecked were small coasters.

However, such a contrast as is presented by the instrumental records of the gale, and its actual practical effect on shipping, is sufficient to show the extreme difficulty of obtaining a completely trustworthy account of so variable an element as wind force from our existing stations. Of course the destructive effect of the storm is to be in a great measure attributed to the high sea which it produced, and partially also to the unsteadiness of the wind, for at almost every station the weather was reported squally. Under such circumstances, though the force of individual gusts may be very high, the hourly velocity will be comparatively moderate.

The fall of rain was very heavy on the 19th. The barometer rose rapidly at all stations during the day, and by 8 a.m. next morning the change had amounted to 0·9 in. at Yarmouth, the depression having entirely passed away. Professor Hildebrandsson says, " The following morning, that of the 20th, the cyclone had split up " into two parts, of which one passed towards the S.E. and was found in the vicinity " of Vienna, the other to N.E. and showed itself in Skania. Both bourrasques went on " in the directions they had taken, and the centre of the last-named was, on the 21st, " in the neighbourhood of Wisby."

The winds on the morning of the 20th at our southern stations were still northerly and strong on the French coast, but in the north they had a tendency to back to the westward under the influence of a fresh slight depression which was making itself felt at the Scotch observatories. This disturbance did not produce any serious effect on the wind except at Sandwick, where a strong breeze from N.W. blew during the day; a similar wind extended to Holyhead at midnight and lasted for a few hours without being felt elsewhere.

During the next few days there was not much change of consequence to report; northerly winds prevailed over France and Spain, which veered to N.E. on the 23rd; however, at Sandwick the wind freshened again from W.S.W. at 9 a.m. on the 22nd and continued to blow with a velocity exceeding 30 miles an hour up to midday on the 24th, by which time it had veered to N.W., occasionally reaching the force of a gale. This disturbance passed on to the coast of Norway and was felt as a gale at Christiansund and Aalesund on the 23rd. At midnight on that day Holyhead again reports a strong northerly breeze lasting for 24 hours.

It is remarkable that a wave of high pressure passed over all the observatories on the morning of the 22nd, the maximum barometrical reading for the month being recorded at every station between 9 and 11 a.m. on that day.

Oct. 25. The barograms, Plate CXIX., show that a depression advanced from the N.W. in the course of this evening. The minimum was reached nearly simultaneously between 7 and 8 p.m. at Armagh, Glasgow, and Aberdeen. It passed Stonyhurst about 2 hours later, and was registered at Kew at 3 a.m. and at Yarmouth at 4 a.m. on the 26th; while at Valencia and Falmouth the oscillation was much less marked. In the south of Norway, however, the depression was very serious, and at Mandal the fall amounted to an inch during the 24 hours preceding 8 a.m. on the 26th. The chart for this day (Fig. 63) bears a general resemblance to that of the 17th (Fig. 59, p. 85), with the exception that the lowest readings in Norway are about 0·2 in. higher than they were on that day. The gradient from Greencastle to Skudesnaes is 11, and so heavy northerly gales are blowing in Scotland and the north of England, without affecting the Irish observatories at all.

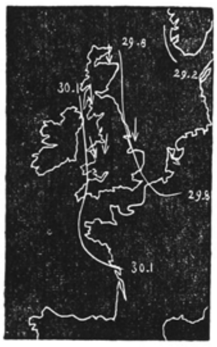

Fig. 63. Oct. 26.

The anemometrical records which have been preserved, and which are given below, show that while it had been blowing freshly from W.S.W. at Sandwick during the 25th, the gale suddenly set in from N.W. at 8 p.m. nearly simultaneously at that station and at Holyhead and Aberdeen, lasting at the two first-named places for upwards of two days. At Skudesnaes also a heavy N.N.W. gale was felt on the 26th, while at Hamburg in the afternoon the wind was south-westerly and squally. On our own coasts, too, the weather was generally reported squally with hail and heavy snow in the north of England.

Oct. 27. The distribution of pressure remained almost unaltered, the gradient from Holyhead to Skudesnaes being as much as 9. The gales continued on our north and west coasts, and had extended southwards to the Channel, becoming general over western Europe, while it was also blowing hard from west in the Gulf of Genoa. At Skudesnaes the storm had moderated, but at Aalesund it had set in from N.N.E. on the evening of the 26th, and lasted throughout the 27th, backing to north.

Oct. 28. The barometer has risen briskly in the south of Norway, so that gradients have become less, and the gale has diminished in severity at most of our stations, still, however, lasting in the St. George's Channel, where it did not die down finally until 7 a.m. on the 29th.

The subjoined table gives the particulars of the gale, and from it we learn that it continued to blow hard during the 28th on the coast of Yorkshire, and that at Yarmouth a very stiff northerly gale was felt during that night.

Observatories.	Velocity. 30-40 Miles per Hour.		Velocity. Exceeding 40 Miles per Hour.				Velocity. Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Glasgow -	10 a.m. (27th).	N. by W.	—	—	—	—	2 p.m. (27th)	N.W. by N.	4	1 p.m. (27th).	N.N.W.	39	—
Aberdeen -	7 p.m. (25th).	N.W. by W.	—	—	—	—	4 p.m. (26th)	N.W. by N.	21	8 a.m. (26th).	N.W.	40	This velocity was only reached for one hour.
	3 a.m. (27th).	N.W. by N.	—	—	—	—	7 a.m. (27th).	N.N.W.	4				
Sandwick -	8 a.m. (25th).	W.S.W.	8 p.m. (25th).	N.W. to N.N.W.	47	54	Noon (28th)	N.N.W.	76	4 a.m. (26th).	N.W. by N.	53	—
Falmouth -	9 a.m. (26th).	N.N.W.	—	—	—	—	5 p.m. (26th)	N.W. by N.	8	1 p.m. (27th.)	N.W. by N.	48	—
	2 a.m. (27th).	W.N.W.	10 a.m. (27th).	N.W. by N.	44	3	4 p.m. (27th)	N. by W.	14				
Holyhead -	7 p.m. (25th).	S.W. by W.	9 p.m. (25th).	N.W. to N.	46	75	7 a.m. (29th)	N.E. by N.	84	7 a.m. (27th).	N.	61	The velocity is not absolutely correct, for the instrument was working somewhat stiffly.
Yarmouth -	2 p.m. (26th).	N.W.	—	—	—	—	6 p.m. (26th)	W.N.W.	4				
	8 p.m. (28th).	N.	Midngt. (28th).	N.	48	6	7 a.m. (29th)	N.E. by E.	11	4 a.m. (29th).	N.	55	—
Bridlington -	9 a.m. (26th).	N.	Noon (26th).	N.	44	2	8 p.m. (28th)	N.N.E.	59	3 p.m. (28th).	N.	48	No lull occurred between the two gales, as was the case at Yarmouth.
			1 p.m. (28th).	N. by E.	45	4							

On the 29th the barometer rose pretty quickly at all our stations, but in the evening a fresh decrease set in at the northern observatories and advanced rapidly southwards, thus following a course similar to those lately noticed.

It is interesting to trace on Plate CXXI. the motion of this slight depression. For want of a better means of determining the precise moment of its passage we shall take the epoch of registration of the minimum barometrical readings on the 30th. This was—

Aberdeen, 1.35 a.m.
Glasgow, 2.0 a.m.
Armagh, 4.30 a.m.
Valencia, 6.20 a.m.
Stonyhurst, 5.45 a.m.
Kew, 8.55 a.m.
Falmouth, 9.0 a.m.

This shows us that the disturbance was propagated in a nearly straight line from Glasgow to Kew, passing directly through Stonyhurst, and that it took $3\frac{3}{4}$ hours to travel the distance of 138 geographical miles, from Glasgow to Stonyhurst. This gives a rate of progression of 37 miles an hour. This estimate is supported by the time, half an hour, taken to advance from Aberdeen to Glasgow. From Stonyhurst to Kew the rate was increased to 52 miles an hour, as the time occupied between those stations, distant 164 miles apart, was only 3 hours and 10 minutes. It is remarkable that the times of registration of the minimum reading at the three western stations differed materially from what we should have expected. At Falmouth it occurred at 9 p.m., whereas the above calculation shows that it ought to have been noticed about 8 o'clock. The times recorded at the Irish stations prove that the disturbance was much delayed in its passage over that island.

The foregoing calculation has been given, not for its own intrinsic value, which is very slight, but with the view of exhibiting the great difficulty of determining accurately the rate and direction of advance of an atmospherical disturbance, even with the aid of self-recording instruments. It will be seen that the data from four of the observatories exhibit a strict accordance *inter se*. Falmouth shows a noticeable discrepancy, while the Irish records disagree entirely with the figures furnished by the instruments in Great Britain. However, at Valencia the oscillation was very much reduced in magnitude, being in fact scarcely perceptible.

The only serious influence exerted on wind by this depression was at Holyhead and Sandwick. At the former station a stiff northerly gale began at midnight on the 29th and lasted till the afternoon. At Sandwick the wind was strong from W.N.W. during the night of the 30th, and continued so up to 9 p.m. on the 31st. This westerly gale was also felt at Christiansund and Aalesund on the same day.

Weather continued moderately calm during the next two days, and temperature was much higher than it had been during the continuance of the northery gales; but on the evening of the 1st the northern barograms began to show the approach of a fresh depression, which was scarcely perceptible at Valencia and Falmouth, but was well marked at all the other observatories, Plate CXXIII. The gale which accompanied it was of no great importance. It will be seen from the following table that it was principally felt at Sandwick and Glasgow, and that it set in at the former station on the evening of the 1st. It lasted generally until midnight on the 2nd.

Observatories.	Velocity. 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Glasgow -	4 a.m. (2nd).	W.S.W.	7 a.m. (2nd).	S.W. by W.	41	10	10 p.m. (2nd)	W. by N.	18	9 a.m. (2nd).	W.S.W.	49	—
Aberdeen -	2 a.m. (2nd).	W.	—	—	—	—	5 a.m. (2nd)	S.W. by W.	3	4 a.m. (2nd).	W. by S.	42	This velocity was only reached for one hour.
	7 p.m. (2nd).	N.W. by W.	—	—	—	—	Midnight (2nd).	N.W. by N.	5				
Sandwick -	8 p.m. (1st).	W.S.W.	Midnight (1st).	W.S.W. veering to W.	47	20	Midnight (2nd).	N.W. by W.	28	6 a.m. (2nd).	W.S.W.	54	—
Falmouth -	10 p.m. (2nd).	W. by N.	—	—	—	—	5 a.m. (3rd)	W. by N.	7	1 a.m. (3rd).	W. by N.	40	This velocity was only reached for one hour.
Holyhead -	9 a.m. (2nd).	W. by S.	7 p.m. (2nd).	W. by S.	42	4	4 a.m. (3rd)	N.W. by N.	19	11 p.m. (2nd).	W. by S.	45	—
Stonyhurst -	5 p.m. (2nd).	W. by S.	—	—	—	—	Midnight (2nd).	W.	7	7 p.m. (2nd).	W. by S.	38	—
Yarmouth -	6 p.m. (2nd).	W.S.W.	—	—	—	—	3 a.m. (3rd)	W.	9	2 a.m. (3rd).	W. by S.	34	—

Nov. 3. The disturbance had passed on to Norway, where a heavy N.N.W. gale was reported at 8 a.m. at Sandosund, and during the forenoon the barometer rose briskly at our northern stations; but this change was only transient, for at noon a fresh fall appeared, which was especially rapid in Scotland, but, like that of the day before, was scarcely registered at Valencia or Falmouth at all.

If we compare Plates CXXIII. and CXXIV. with each other, we notice that the thermograms show a sudden rise of temperature at Armagh, Glasgow, Stonyhurst, and Kew. This phenomenon is nearly coincident in time with the registration of the barometrical minimum. On looking to the anemometrical records for an explanation of the thermometrical oscillation, we see that although the wind did "back" temporarily at all the stations named, yet that the change of temperature took place about an hour subsequently to the "back" of wind observed. At Aberdeen, also, where the shift of wind was more marked than anywhere else, the thermometrical oscillation was scarcely marked.

This fresh depression was not accompanied by a serious gale. However, at Holyhead the wind was pretty strong, as well as at Falmouth and Sandwick, and on the west coast of Great Britain generally. At Wick a heavy thunderstorm occurred about midday. The disturbance passed across the North Sea to Denmark, and at noon on the 4th the lowest barometrical reading that had been observed in November for 11 years was recorded at Hamburg. It was 28·738 in.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	5 a.m. (4th).	W.N.W.	—	—	—	—	7 a.m. (4th)	W.N.W.	2	6 a.m. (4th).	W.N.W.	32	—
Glasgow -	8 a.m. (4th).	W.N.W.	—	—	—	—	9 p.m. (4th)	W.N.W.	13	10 a.m. to noon (4th).	W.N.W.	35	—
Aberdeen -	4 p.m. (4th).	N.W. by W.	—	—	—	—	11 p.m. (4th)	N.W. by W.	7	6 p.m. (4th).	N.W. by W.	38	—
Sandwick -	1 a.m. (4th).	S.W. by S.	2 a.m. (4th).	W. by N.	41	10	Noon (4th)	W. by N.	11	8 a.m. (4th).	W. by N.	44	—
Falmouth -	7 p.m. (3rd).	W. by N.	11 p.m. (3rd).	W.N.W.	45	8	1 a.m. (5th)	N.W. by W.	30	1 a.m. (4th).	W. by N.	49	—
Holyhead -	7 p.m. (3rd).	S.W.	2 a.m. (4th).	N.W. by W.	47	22	4 a.m. (5th)	W.N.W.	33	7 p.m. (4th).	N.W.	57	—
Stonyhurst -	1 a.m. (4th).	W. by N.	—	—	—	—	2 p.m. (4th)	N.W.	13	6 a.m. (4th).	W. by N.	40	This velocity was only reached for one hour.
Yarmouth -	8 a.m. (4th).	W. by N.	—	—	—	—	5 p.m. (4th)	W.N.W.	9	10 a.m. to noon (4th).	W.N.W.	35	—

Nov. 5. A brisk rise having occurred in the north the distribution of pressure was more uniform than it had been of late, and the winds were generally light from west, except in the extreme north, where at Wick and Sandwick a strong westerly breeze of a few hours duration was felt. Cape Clear also reported a N.W. gale.

The atmosphere was, however, in a very disturbed condition, for at 8 a.m. the barometer at Armagh had begun to fall, and during the afternoon a serious depression passed over us, which was most marked at Stonyhurst, and of less importance at Valencia and Aberdeen than elsewhere.

The thermometrical oscillations at Armagh, Stonyhurst, and Kew were even more striking (Plate CXXIII.) than those above noticed on the night of the 3rd.

At Armagh the wind backed to South at 11 a.m. and veered to S.S.W. at 1, at which time the sudden rise of temperature took place; at the epoch of the maximum temperature the wind was W. by S., veering rapidly towards N.W.

At Stonyhurst the change of temperature was very sudden and of short duration. It coincided in time with a complete "back" of the wind round the compass. At Kew the wind, which had almost been southerly at 3 p.m., was veering steadily towards N.W., and the vane was at W. when the maximum temperature was recorded, at 3 a.m. on the 6th. It is also noticeable that at the same station when the wind had reached N.W. and began to back again towards W., the thermometer fell quickly, and the temperature remained very low during the night. These phenomena are scarcely traceable elsewhere.

The depression had entirely left our coasts on the morning of the 6th, when its centre was situated over Denmark.

The only gales which were felt on the 5th and 6th were on the west coast of England, where at Holyhead the wind, after a temporary lull from the previous gale, backed to south and then freshened at noon to a strong breeze, veering to N.W. and lasting throughout the next day. The velocity of a gale was attained for a few hours about midnight, the direction being N.N.W.

At Falmouth also a slight gale from W. was felt during the night of the 5th, and at Sandwick a strong wind from N.N.W. was recorded, which set in at 3 a.m. on the 6th, maintaining the velocity of 30 miles an hour for 28 hours, and reaching that of a gale from 5 p.m. to midnight.

Pressure recovered during the afternoon of the 6th, and continued steady up to noon on the 7th, when another depression appeared, which like its predecessors was confined to the northern stations and Kew, being entirely unnoticeable at Falmouth or Valencia. This caused a fresh gale from S.W. at Holyhead on the night of the 7th, which was also felt at Stonyhurst. At the Scotch observatories the wind veered to N.W. and increased to a moderate gale as soon as the barometer began to recover. At Yarmouth, too, a S.W. gale was felt during the 8th, on which day Mr. Stow at Whitby also reports a gale, but its direction was N.W.*

From this to the 12th the weather was, for the most part, calm and fine, especially on the 11th; on the 9th, however, a N.W. gale was felt at Sandwick and at the other Scotch stations; which also affected Holyhead, where it lasted up to the evening of the 10th.

Nov. 12. A steady fall is perceptible in all the northern barograms, Plate CXXVII., while temperature rose rapidly at all the observatories about midday, the change being especially marked at Kew. This disturbance produced a slight S.W. gale at several stations, which seems to have had most force in the north of Ireland and England, having been felt both at Armagh and Stonyhurst.

Observatories.	VELOCITY, 30-40 Miles per Hour.		VELOCITY, Exceeding 40 Miles per Hour.				VELOCITY Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	MAXIMUM VELOCITY.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	11 am. (12th).	S.	6 a.m. (13th).	S.S.W.	41	8	2 a.m. (14th)	S.W. by W.	39	2 p.m. (13th).	S.W. by S.	45	—
Armagh -	8 p.m. (12th).	S.W. by S.	—	—	—	—	11 a.m. (13th)	S.W.	15	10 a.m. (13th).	S.W.	35	The paper was torn by the pencil at 2 a.m. on 13th, but it seems probable that the gale lasted till 10 a.m. when the new paper was put on.
Holyhead -	10 a.m. (12th).	S.W.	7 p.m. (12th).	S.W.	43	23	6 a.m. (14th)	S.W. by W.	44	11 a.m. (13th).	S.W. by S.	49	—
Stonyhurst -	4 a.m. (13th).	W.S.W.	—	—	—	—	4 p.m. (13th)	W.S.W.	12	2 p.m. (13th).	W.S.W.	36	The wind continued to blow freshly from W.S.W. up to noon on the 14th.

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* The anemograph at Bridlington ceased working at the end of October, so that we are unfortunately unable to give instrumental records for the coast of Yorkshire.

At the Scotch observatories a strong breeze from S.S.W. was registered for an hour or two during the night. At Sandwick the increase of force lasted throughout the 13th, and at Yarmouth also the breeze was felt on the afternoon of that day.

Matters continued quiet during the 14th with the exception of a stiff S.W. breeze at Glasgow and Falmouth. The rainfall which accompanied this breeze was very heavy at all the north-western stations.

On the 15th we notice a depression which followed a path more usual than those lately described, appearing first at Valencia and passing off over Armagh and Glasgow, and probably over Aberdeen too, did not the absence of the barogram prevent our tracing it. At the English observatories it is quite unnoticeable. Its only effect was to produce a short though sharp S.W. gale at Valencia and Holyhead, which lasted at the former station from 2 a.m. to 9 p.m., and averaged a velocity of 50 miles an hour from 1 to 8 p.m. At Holyhead the velocity of 30 miles an hour was reached at noon, that of 40 at 9 p.m., and the gale ended at 3 a.m. on the 16th. This gale was hardly felt at the other stations.

From this to the evening of the 20th the weather was on the whole fine and dry, and there was nothing of consequence to report excepting that the wind was stiff from S.W. at Valencia on the 17th and at Holyhead on the 17th and 18th. This same disturbance apparently passed over Sandwick, lasting as a gale from 6 p.m. on the 18th to 1 p.m. on the 20th, and averaging a velocity of 49 miles an hour all day long on the 19th.

This wind was felt also in the west and north of Scotland, but the failure of the anemograph at Glasgow unfortunately precludes our tracing it. It passed on to Norway and was felt at Christiansund and Aalesund, though it did not attain serious force. The gale was caused by the passage of a depression to the northward of these islands, of which the minimum reading was recorded at Christiansund and Aalesund at 2 p.m., at Bodö at 8 p.m. on the 19th, while the Bulletin International shows the centre at Hernosand on the 19th, and at Haparanda on the 20th.

Nov. 21. Shortly before midnight on the 20th the barograms at all excepting the English observatories had begun to betray symptoms of a decrease, as will be seen from Plate CXXIX., and during the course of this day and the next the most remarkable phenomenon we have yet had to chronicle passed over these islands. The amount of atmospherical pressure was diminished to the extent of more than an inch at all the observatories between midnight on the 20th and the same hour on the 21st. The total amount of fall registered at each station, except Aberdeen and Stonyhurst, will be found in the table at p. 107 for the maximum reading was registered at every observatory between the 18th and 20th, and the minimum occurred on the 22nd at Valencia, Armagh, Glasgow, and Falmouth, and on the 23rd at Kew. At Aberdeen and Stonyhurst lower readings had been obtained earlier in the month.

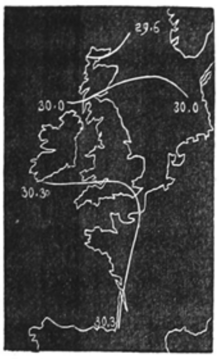

Fig. 64. Nov. 21.

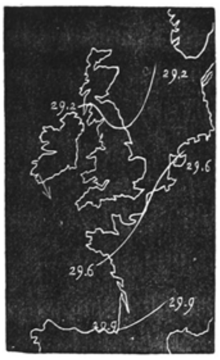

Fig. 65. Nov. 22.

A comparison of Figs. 64 and 65 will show the nature of the change which took place, and of which the maximum effect was observable over these islands. On Fig. 64 we see an area of readings above 30·30 in. covering the Channel and the west of France, while the isobar of 29·6 just crosses Caithness. At Wick a fall of 0·65 in. being already reported since the previous morning. Fig. 65 for the 22nd exhibits the isobar of 29·2 passing in a bend from Glasgow down to Scarborough, and thence in a N.N.E. direction, while that of 29·6 takes a nearly straight course from L'Orient to Helder. The highest isobar on the chart, 29·9, lies along the north coast of Spain. The actual fall of the barometer since 8 a.m. on the 21st had exceeded 0·9 in. over the entire district stretching from Dover to Valencia and from L'Orient to Shields. This area is bounded by the meridians of 1° E. and 11° W. and by the parallels of 48° and 55°, and its superficial extent is about 200,000 geographical square miles. It is very hard to realise the magnitude of such a disturbance, and, in the present state of our knowledge of meteorology, impossible to assign a cause to it.

The entire phenomenon yields conclusive evidence to the truth of the proposition that the violence of storms depends on the distribution of pressure and not on its absolute amount, or even on the rate of its change. On this occasion, though there was such an enormous disturbance of equilibrium, there was absolutely no strong wind reported on our coasts during the day, except a slight N.W. gale at C. Clear and one from S.E. at Yarmouth. A very serious storm was, however, raging over the Atlantic just outside our shores. This was first reported at midnight on the 21st by the "Scotia," Captain Judkins, near Cape Clear, and by the "Inverness," Captain Dunkin, in lat. 46° N. and long. 11° W. On the 22nd it was experienced not only by these vessels but also by the "City of Brooklyn," Captain Brooks, and by the barque "Foam," Captain Alfred Fry. The last-named vessel, which was in the latitude of Corunna and in 16° W. long., suffered severely in the gale and was driven to the southward. The storm lasted with her and the "Inverness," which had by this time approached her, all through the 23rd. The wind throughout was from W.N.W. to N., the force averaging, in squalls, from 10 to 11 Beaufort scale. At Corunna, however, and on the coast of Portugal, the gale was not felt seriously at all.

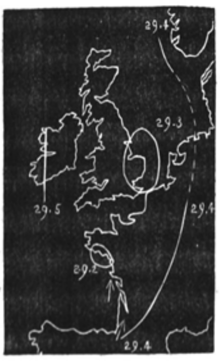

Fig. 66. Nov. 23.

Nov. 23. Fig. 66 shows us that pressure is uniformly low in amount; two separate areas are noticeable, one of 29·2 over Brittany, the other of 29·3 embracing our eastern counties. The only gales are those in the south of the Bay of Biscay, which are from south. There was no wind to speak of during the day, except a slight gale from N.W. and N. respectively at Sandwick and Holyhead.

The barometer continued reasonably steady during the next few days, and the most remarkable phenomenon noticeable in the automatic records is the peculiar period of calm which passed over all the stations on the 24th and 25th.

Nov. 27. A slight depression appeared in the barograms for Valencia and Falmouth, causing a moderate S.W. gale at all the south-western stations, which was scarcely felt elsewhere. In the evening a similar gale was reported from Christiansund and Aalesund, in Norway. The amount of rain which fell on this day in the midland and southern counties of England has been made the subject of an interesting discussion by Mr. Symons, in his Rainfall for 1869, pp. 89, *et seq.* It was noticed as the heaviest fall on any day during the year at 71 of his stations situated in the district named. The amount registered at our own stations exceeded an inch at Plymouth and Kew, and approached that figure at Pembroke and Plymouth. According to Mr. Symons, the fall was heaviest along the parallel of 51° 30′; it decreased to nothing about 54° N., and we learn from the Daily Weather Reports that it was scarcely felt on the coast of France.

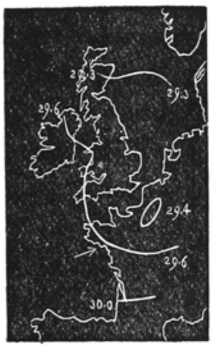

Fig. 67. Nov. 28.

On the whole, pressure was unsteady, and at 8 a.m. on the 28th an oval area of depression lay over the north-east of France, as is shown by Fig. 67. Gradients were steepest over the Bay of Biscay, and a westerly gale was reported from L'Orient. The wind, however, soon increased to a gale from N.W. at Holyhead and in the Orkneys. At the former station the velocity of 30 miles an hour was exceeded for 18 hours from 6 a.m., that from 5 to 7 p.m. averaging 53 miles. At Sandwick the velocity of 30 miles was not reached until 1 p.m., and it lasted for 24 hours, the maximum force, 52 miles an hour, being recorded from 2–4 a.m. on the 29th.

It will be seen from Plate CXXXIII. that a rapid recovery of pressure occurred at all the observatories on the evening of the 28th, which was immediately followed by a fresh decrease, principally confined to the southern stations, being hardly noticeable at Aberdeen.

The barograms, thermograms, and anemograms for Valencia and Falmouth exhibit a most striking similarity to each other on the 29th, as if the same identical causes had been operating in each instance. At Valencia the wind backed to E.S.E., but did not increase to more than a strong breeze lasting for six hours. At Falmouth the "back" was only to South, but the wind rose to a moderate gale from W. for six hours from 2 p.m., veered to N. by 5 a.m., and did not fall below the velocity of 30 miles an hour for 42 hours. At Holyhead the wind backed even as far as E., the gale began from N.E. at 11 p.m., backed gradually to N.W., and averaged 48 miles an hour for 28 hours from midnight on the 29th. At Sandwick a strong N.N.W. breeze lasted for 24 hours from 2 a.m. on the 30th.

These winds were all caused by the passage along the south coast of England of a depression which, as we see from Plate CXXXIII., was much less marked in the north.

Nov. 30. The area of lowest readings lay over Luxembourg, while the northerly gales were blowing hard on the west coast of England. It is remarkable that although the wind in the south of Ireland was moderate from N.E., Captain Fry, in the "Foam," experienced a heavy north-west gale, off the Bay of Biscay, in lat. 48°, long. 10° W.

During the day a general rise of the barometer, varying from 0·3 to 0·5 in., occurred over the British Islands. It was about uniform at Valencia and in the south-east, so that the gradient from Valencia to Cape Grisnez remained unchanged, but as the rise in the west of France was greater than in the east, the northerly winds on the north coast of that country increased in force, while the gale abated somewhat at the British stations.

Before midnight on the 1st a fresh decrease showed itself in Ireland, the effect of which was entirely to reverse the gradients and cause the wind to moderate and shift to the southward for a time.

Dec. 3. The disturbance seems to have moved outside the Cornish coast to the west of France, where a slight fall is reported. A fresh rise of the barometer appears at our northern stations, so that the wind again shifted to E. and N.E. At 9 a.m. it increased in force to a strong breeze from E. at Falmouth and from N. at Yarmouth, which lasted, however, only four hours at either station.

The rise of the barometer made steady progress in Scotland during the day, and accordingly before midnight the gale had recommenced at Yarmouth and Holyhead.

Dec. 4. The chart for this day shows a local diminution of pressure over the south-east of England, and on looking to the barograms, Plate CXXXV. discloses a most remarkable state of affairs, for a depression is shown at Kew which *apparently* manifests itself subsequently at Stonyhurst, and last of all at Falmouth, being hardly perceptible elsewhere.

Judging from the records of these three observatories *it would appear as if this depression had advanced from east to west*, but it is not safe to speak positively on such slight evidence. There is also some uncertainty about the precise epoch of the lowest barometer reading, as the curves are all rather flat about the time of its occurrence; however, that for the Milne barograph at Yarmouth bears a close resemblance to the photographic record for Kew, and we find that on it the cessation of the fall, which was noticed at Kew, Plate CXXXV., at 4·45 a.m., had been registered at 1 a.m. At Stonyhurst the minimum was recorded at 8 a.m., and at Falmouth at 4.30 p.m.

The gale itself was strictly confined to the three stations given in the subjoined table. It was nowhere of great violence, and is chiefly remarkable for its long persistence at Falmouth, while at Holyhead there were two distinct freshenings of the wind, and at Yarmouth the second gale did not appear at all. The only vessel which experienced this disturbance was the "Foam," which was by this time about 50 miles to the westward of the Scilly Islands. The storm lasted for two days.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Falmouth -	9 a.m. (4th).	N. by W.	1 a.m. (5th).	N.E.	44	5	11 a.m. (8th)	S.E. by E.	98	5 a.m. (5th).	E.N.E.	46	—
Holyhead -	8 p.m. (3rd).	N.E.	1 a.m. (4th).	N.N.E.	47	16	6 p.m. (4th)	E.	22	4 p.m. (4th).	N.N.E.	53	—
„	10 a.m. (6th).	E.	8 p.m. (6th). 2 a.m. (8th).	E. E.N.E.	44 45	10 6	10 a.m. (8th)	E.	48	4 a.m. (7th).	E.	50	—
Yarmouth -	3 p.m. (3rd).	N.	4 a.m. (4th).	E.N.E.	47	2	7 p.m. (4th)	E.	28	6 a.m. (4th).	E.N.E.	48	Second gale not felt at all.

For the next three days steady easterly winds were felt at all the English stations; at Valencia, however, though the wind was light the vane was very unsteady. Weather was for the most part dry, but overcast, and in places foggy. The barometer rose briskly during the 5th and fell again slowly from the 6th until the 8th.

Dec. 10. The chart for this morning shows a decrease of pressure exceeding half an inch at Wick, and Plate CXXXVII. exhibits a very remarkable depression which passed over all the observatories and presents some peculiarities worthy of great attention.

The wind which accompanied it was from south. It was only felt as a gale at the western stations, and it ceased suddenly as soon as the motion of the barometer changed from falling to rising.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	6 a.m. (10th).	S. by E.	3 p.m. (10th).	S. by W.	48	5	9 p.m. (10th).	W. by S.	15	6-8 p.m.	S. by W.	50	—
Armagh -	3 p.m. (10th).	S.	—	—	—	—	9 p.m. (10th).	S.	6	4 p.m. (10th).	S.	38	—
Glasgow -	11 a.m. (10th).	S. by W.	—	—	—	—	11 p.m. (10th).	S.S.W.	12	8 p.m. (10th).	S.	40	—
Sandwick -	8 a.m. (10th).	S.S.E.	—	—	—	—	2 p.m. (10th).	S.	6	1 p.m. (10th).	S.	40	—
Holyhead -	7 a.m. (10th).	S.	6 p.m. (10th).	S.S.W.	50	8	3 a.m. (11th).	S.S.W.	20	10 p.m.-Midnight (10th).	S. by W.	53	—
Stonyhurst -	3 a.m. (11th).	S.	—	—	—	—	6 a.m. (11th).	S.	3	6 a.m. (11th).	S.	35	—

In the barograms for the Irish stations and Glasgow a sudden recovery is noticed, which is absolutely simultaneous with the shift of wind from South, and is accompanied by an equally sudden fall of temperature. It is still further worthy of notice that all the thermograms exhibit this sudden depression except that for Stonyhurst, where its effect is very slight and the wind did not shift nearly so quickly. The time of the phenomenon is very clearly marked, being at

Valencia	9.0 p.m. 10th.	Aberdeen	1.30 a.m. 11th.
Armagh	10.15 p.m. „	Falmouth	6.0 a.m. „
Glasgow	11.15 p.m. „	Stonyhurst	7.0 a.m. „
		Kew	6.0 p.m. „

Dec. 11. Barometrical readings were uniformly low on this day, decreasing from about 30 in. over Switzerland to 29 in. at Wick and Christiansund. Winds were consequently moderate to light from S.W. Not much change occurred during the day except a slight rise of the barometer in the west which caused the wind to veer to N.W. on the south coast of Ireland.

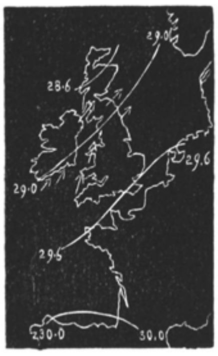

Fig. 68. Dec. 13.

Dec. 13. The barograms at the northern stations exhibited a decrease even before midnight on the 12th, which soon became very rapid, so that Fig. 68, for this day, shows a serious disturbance of pressure. The total difference of readings between Biarritz and Wick is 1·48 in., and the gradients are very steep, that across the entrance of the Channel from L'Orient to Valencia being 10, that from Helder to Nairn 14, and that from Scarborough to Ardrossan as much as 15. Accordingly we find that a very severe south-west gale is sweeping in a broad belt from the south of Ireland to the Firth of Forth, while to the N.W. and S.E. of this area winds are comparatively moderate. The following table shows that the gale was felt at all the observatories, being the first which was so general since that of the 28th of January, which, however, exceeded it in violence. It extended as far south as to lat. 47°, where it was felt by the "Ptolemy," Capt. Hayes, on the meridian of Valencia, and was recorded at 23 of the telegraphic reporting stations.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	8 p.m. (12th).	S.S.W.	10 p.m. (12th).	S. veering to SW.	49	20	10 p.m. (13th).	W.S.W.	26	2 a.m. (13th).	S. by W.	60	—
Armagh -	2 a.m. (13th).	S.	—	—	—	—	8 p.m. (13th).	S.S.W.	18	2 p.m. (13th).	S.	45	The velocity of 40 miles an hour was reached at times during the day.
Glasgow -	3 a.m. (13th).	S.	5 a.m. (13th).	S.	46	3	1 a.m. (14th).	W. by S.	22	7 a.m. (13th).	S. by E.	50	—
			3 p.m. (13th).	S. by W.	46	5				6–8 p.m. (13th).	S. by W.	49	—

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Aberdeen -	5 a.m. (13th).	S.	—	—	—	—	10 a.m.(13th).	S.	5	7 a.m. (13th).	S.	44	This velocity was only marked for one hour. The wind fell quite light about noon.
	6 p.m. (13th).	S.	—	—	—	—	9 p.m. (13th).	S.S.W.	3				
Sandwick -	5 a.m. (13th).	S.E. by S.	6 a.m. (13th).	S.S.E.	45	4	10 a.m.(14th).	W.N.W.	29	4 a.m. (14th).	W.N.W.	54	The wind fell much lighter during the afternoon of the 13th.
			2 a.m. (14th).	W.N.W.	48	6							
Falmouth -	3 a.m. (13th).	S.W.	9 a.m. (13th).	S.W. by S.	47	6	6 p.m. (13th).	W.S.W.	15	2 p.m. (13th).	S.W. by S.	50	—
Holyhead -	8 p.m. (12th).	W.S.W.	2 a.m. (13th).	S.S.W.	51	22	5 a.m. (14th).	W.	33	5–7 a.m. (13th).	S.S.W.	57	—
Stonyhurst -	6 a.m. (13th).	S. by W.	11 a.m. (13th).	S.	44	2	3 p.m. (13th)	S.W.	9	11–1 p.m. (13th).	S.	44	—
Kew -	10 a.m. (13th).	S.S.W.	—	—	—	—	9 p.m. (13th)	S.W. by W.	11	2 p.m. (13th).	S.S.W.	40	This velocity was only reached for one hour.
Yarmouth -	10 a.m. (13th).	S.	—	—	—	—	10 p.m.(13th)	S. by W.	12	6 p.m. (13th).	S.	39	—

Plate CXXXIX. shows a remarkable change in the rate of fall of the barometer at the three northern observatories, which was recorded at Armagh at 8 a.m., at Glasgow at 9, and at Aberdeen shortly after 10. This check was only temporary, and the mercury continued to fall, especially in the north, until at 10 p.m. the absolute minimum for the year, 28·259 in., was registered at Aberdeen. At the same hour the unusually low reading of 28·1 was observed at Nairn.

On examining the curves the unsteadiness of pressure at the Irish and Scotch observatories is well deserving of notice, as well as the fact that the trace for Stonyhurst bears very little resemblance to that for Armagh. This circumstance is the more striking, inasmuch as the curves from these two observatories for the very next depression are very similar to each other.

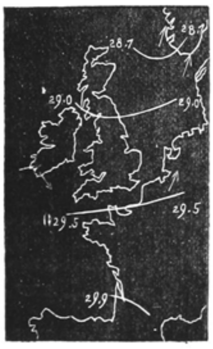

Fig. 69. Dec. 14.

Dec. 14. Readings had recovered very briskly in the north during the night, so that Fig. 69 for this day shows us much greater uniformity of readings than had prevailed on the previous day, the only gales reported in western Europe being those from W.N.W. in the south of Ireland and from S.W. at Brussels, while the S.W. gales had advanced to Norway.

The recovery of pressure lasted only till the evening, when a fresh decrease made its appearance and passed over all the observatories, being most marked in the north. This disturbance caused the wind to back to S.S.W. at the western stations, and during the night a gale from S.W., veering to W. by N., was felt at Valencia, Falmouth, and Holyhead, and at all the western telegraphic stations. Much lightning was observed at Nairn and at Cork.

It will be noticed, as already observed, that the barogram for this day for Stonyhurst is very similar to that for Armagh.

Fig. 70, for the 15th, exhibits a small area, with readings below 28·8 in., whose centre is near Dundee, while westerly gales are blowing at all our western stations, and a south-westerly one of equal force is reported from Holland and Belgium. At Hamburg the gale had begun at midnight but died down by the morning. At our own eastern stations the gale was not felt at all.

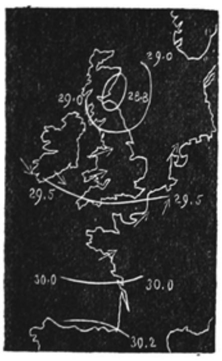

Fig. 70. Dec. 15.

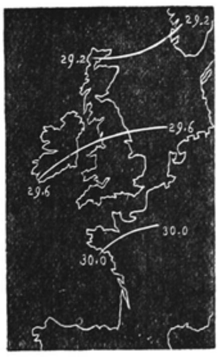

Fig. 71. Dec. 16, 8 a.m.

Dec. 16. A brisk rise having occurred at all stations pressure this morning is fairly uniform, Fig. 71, and winds light from the west. A depression is, however, in progress at Valencia which advanced with most remarkable velocity. The barometer at Valencia fell very rapidly about noon, at which time the wind shifted from S. through E. and N. to W., remaining light in force. Plate CXXXIX. shows us that the depression was most marked in its character at the southern stations. At Stonyhurst too it was very serious. The absolute minimum was recorded at Valencia at 2·45 p.m.; at Kew at 9·30; and at Yarmouth, where the Milne barogram shows a fall of 0·1 in. between 5 and 6 p.m., and of 0·2 in. per hour from 6 to 8, the minimum was reached at 10 p.m., and the mercury continued at this low reading for four hours. The interval which elapsed between the registration of the minimum at Valencia and Yarmouth is 7¼ hours, and as the distance between the stations is 445 geographical miles the velocity of propagation of the storm is 61 geographical, or upwards of 70 English, miles per hour.

It seems probable that this is a fair estimate of the rate of progression of the centre of the storm, for the shift of wind recorded at Valencia and Holyhead shows that the centre passed south of both of those stations, and it is equally clear from Plate CXL. that it passed north of Falmouth and Kew. A very remarkable corroboration of this statement is found in a comparison of two logs kept by very careful observers. The "Tenasserim," Capt. Potts, was in 50° 56′ N. and 11° 25′ W., and she experienced a heavy southerly gale at noon, which was of short duration, and veered to west. The "Tarifa," Capt. Murphy, was in 51° 22′ N. and 10° W., very near Cape Clear, and she felt a moderate south-west breeze backing through E. and N. to N.W. Thus we see that at one of these ships the record of wind was similar to that registered at Falmouth, while at the other it resembled the record at Valencia. In both vessels

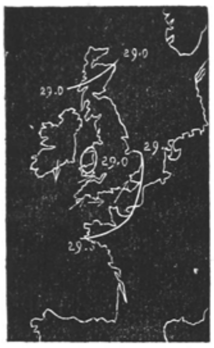

Fig. 72. Dec. 16, 6 p.m.

the least reading was noticed at noon; but as the observations are only taken at four-hourly intervals, the precise epoch of the minimum cannot be determined. It appears that the centre of the storm passed actually between these two ships, which were distant only about 60 miles from each other.

Fig. 72 exhibits the depression at 6 p.m. situated over the centre of Wales, while at the same time an area of equally low readings exists off the north coast of Scotland.

The subjoined table gives the recorded velocity of the storm, which was only felt in the Channel, where, however, owing to its suddenness, it did a good deal of damage. It was accompanied by very heavy rain, which continued during the next three days.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Falmouth -	11 a.m (16th).	S.	Noon (16th).	S. veering to W.	51	11	7 a.m. (17th)	W. by N.	20	6 p.m. (16th).	W.S.W.	64	—
Holyhead -	8 p.m. (16th).	N.W.	10 p.m. (16th).	W.N.W.	44	8	Noon (17th)	W.N.W.	16	1–3 a.m. (17th).	W.N.W.	48	The wind in the evening of the 16th had shifted from S. through E. to N.W. as at Valencia.
Stonyhurst -	7 a.m. (17th).	W.	—	—	—	—	Noon (17th)	W.	5	9 a.m. (17th).	W.	32	—
Kew - -	5 p.m. (16th).	S.	9 p.m. (16th).	W.S.W.	42	2	3 a.m. (17th)	W. by N.	10	10 p.m. (16th).	W. by S.	42	—
Yarmouth -	6 p.m. (16th).	S.E.	11 m.p. (16th).	W. by S.	47	2	7 a.m. (17th)	W.	11	1 a.m. (17th).	W.	47	—
Sandwick -	2 a.m. (17th).	W.S.W.	6 a.m. (17th).	N.W. by W.	43	3	4 p.m. (17th)	W.N.W.	14	8 a.m. (17th).	N.W.	44	—

In the north pressure remained very low during the day, so that the gradients for east winds were very slight, and although the centre of the storm passed over the south of Great Britain, no east winds whatever were observed. On the contrary, the influence of the northern depression was so serious that it produced a *westerly* gale at Sandwick, as is shown in the foregoing table.

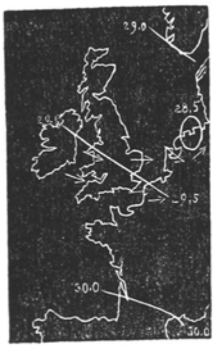

Fig. 73. Dec. 17, 8 a.m.

Dec. 17. On Fig. 73 we find the southern depression at 8 a.m. quite outside our coasts, and situated near the mouth of the Elbe, for at 9 a.m. Herr von Freeden records the reading of 28·334 in. at Hamburg, and characterizes it in his daily "Wetterbericht" as "unheard of, never before observed by me." The wind was a heavy storm from W.S.W., as is shown on Fig. 73, and is also proved by the log of the "Sir C. Campbell," then leaving the Elbe. The rapid rise of the mercury which succeeded this depression was of short duration, for by midnight a new decrease of pressure had set in at the western stations, accompanied by a rapid rise of temperature, and a southerly gale, principally confined to our south coasts.

Dec. 18. Fig. 74 shows that the isobars ran from S.W. to N.E., the steepest gradients being in the south-western district, where temperature is also very high for the season. Plate CXLI. exhibits some most interesting facts about this day. The sudden rise of the mercury from the lowest point, with the accompanying lull, and shift of wind to west, as well as the fall of temperature, all which phenomena are absolutely simultaneous, enable us to trace with great accuracy the passage of the disturbance over our islands. These changes were less marked in England than in Ireland or Scotland. At Glasgow the very remarkable oscillation of temperature merits especial notice, as it coincides precisely in time with the shift of wind from N. to S. and then again to W. The barometer remained at a low level during the night of the 18th, so that the chart for next morning, Fig. 75, shows a state of things closely resembling what existed at the time of the passage of the minimum. The lowest reading, 28·6 in., is reported from Wick, and the highest, 30·34 in., from Madrid. A stiff westerly gale is blowing in the south, one from S. at Orkney, and from S.E. at Skudesnaes.

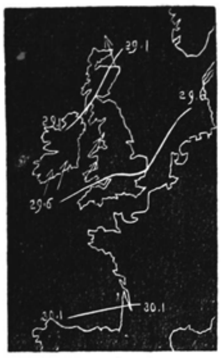

Fig. 74. Dec. 18.

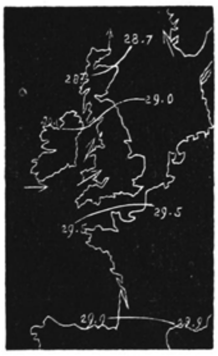

Fig. 75. Dec. 19.

Observatories.	Velocity, 30–40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia	6 p.m. (17th).	S.S.E.	7 p.m. (17th).	S.S.E.	47	19	2 p.m. (18th)	S.	20	2 p.m. (18th).	S.	56	—
	10 p.m. (18th).	S.W.	—	—	—	—	7 p.m. (19th)	W.	21				—
Sandwick	6 a.m. (18th).	S.E.	8 a.m. (18th).	S.E. by S.	45	5	4 p.m. (18th)	S.S.E.	10	11 a.m. (18th).	S.E. by S.	50	—
	6 a.m. (19th).	S.S.W.	5 p.m. (19th).	W.S.W.	56	8	7 p.m. (20th)	W.S.W.	37	7–9 p.m. (19th).	W.	62	—
Falmouth	1 a.m. (18th).	S.W. by S.	10 a.m. (18th).	S.W.	46	12	11 p.m. (18th)	W. by N.	22	6 p.m. (18th).	S.W. by S.	50	—
	6 a.m. (19th).	S.W. by W.	—	—	—	—	10 p.m. (19th)	W.	16				
Holyhead	Midnight (17th).	S.	4 p.m. (18th).	S.W. by S.	43	5	11 p.m. (19th)	W. by N.	47	8 p.m. (18th).	S.W. by S.	47	—
Kew	4 p.m. (18th).	S.W. by W.	—	—	—	—	2 a.m. (19th)	S.W. by S.	10	9 p.m. (18th).	S.W. by S.	32	—

It will be seen that the wind had freshened again at Valencia and Falmouth, and at Sandwick the second gale was by far the more severe. It was accompanied by a fresh fall of the barometer at all the stations.

The wind ultimately died down before night, and weather continued calm for the next two days. Capt. Martyn, however, in the "Samaria," records a N.N.W. gale off the S.W. coast of Ireland. On the 21st, however, readings were generally low, but recovering in the north, and by next morning this rise had produced a gradient of 7 from Greencastle to Holyhead, so that a northerly gale had already set in over the Irish Sea. During the day a slight depression is noticeable in the Falmouth barogram, which was nearly coincident in time with the maximum force of wind at Holyhead. The gale was felt at 9 a.m. at Whitby and began at Yarmouth at 4 p.m.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Yarmouth -	4 p.m. (22nd).	N.N.E.	9 p.m. (22nd). 2 p.m. (23rd).	N.N.E. N. by E.	42 46	7 9	8 p.m. (24th).	N. by E.	52	5-7 p.m. (23rd).	N.N.E.	51	—
Holyhead -	Midnight (21st).	N.N.E.	4 a.m. (22nd).	N.N.E.	50	43	6 p.m. (24th).	N.E.	66	1-3 p.m. (22nd).	N.N.E.	65	—

It is very remarkable that while this disturbance of weather lasted for nearly three days at Holyhead, and for more than two at Yarmouth, it was scarcely felt at any of the other observatories. A southerly gale was reported from the Mediterranean.

The barometer rose steadily at all the stations up to midday on the 24th, when it began to fall slowly, and in the course of the 25th and 26th a depression passed us, which was remarkable in that its character was different at each observatory, Plate CXLIII. It was most marked at Stonyhurst, and the wind was strongest at Holyhead.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity Exceeding 40 Miles per Hour.				Velocity Fell below 30 Miles per Hour.		Total No. of Hours the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Commenced.	Direction of Wind.	Commenced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Aberdeen -	10 p.m. (25th).	N. by E.	1 a.m. (26th).	E.	46	5	1 p.m. (26th)	E.	15	2 a.m. (26th).	E. by N.	54	—
Sandwick -	5 p.m. (25th).	N.E. by N.	5 p.m. (25th).	N.E. by N.	43	6	2 a.m. (26th)	N.E. by N.	9	9-11 p.m. (25th).	N.E.	45	—
Holyhead -	8 p.m. (25th).	N.N.E.	Midnight (25th).	N.	55	26	4 a.m. (27th)	E.N.E.	32	6 a.m. (26th).	N.	73	—
Yarmouth -	5 a.m. (27th).	E.N.E.	9 a.m. (27th).	N.E.	46	7	9 p.m. (27th).	N.	16	11 a.m. (27th).	N.E.	53	—

It will be seen that the storm was very local, in fact this is the remarkable occasion to which allusion has already been made in the Introduction, p. vii., inasmuch as while the hourly velocity at Holyhead between 1 a.m. and noon on the 26th averaged 62·5 miles, the mean velocity at the two stations nearest to it, Armagh and Stonyhurst, was only 12 and 17 miles respectively. A strong northerly gale was also reported from the Naze, in Norway.

The gale was accompanied by a heavy and very general fall of snow, which was most severe on the east coast. This was the precursor of the lowest temperature of the season, which was registered at this period at all the observatories except Aberdeen.

The barometer remained steady on the 27th and 28th, and the wind was easterly on the first of these days, but on the second it backed to west and south and began to blow a gale from the last-named point at 8 p.m., which, however, did not extend beyond the south of Ireland and St. George's Channel. It is worth notice that on the 29th and 30th, the "Minero," Capt. Carruthers, felt a strong gale shifting from S.E. through S. to N.W. Her position throughout the gale was about in 16° W. and on the parallel of Rochefort. This disturbance apparently did not advance to the coast of Europe at all; at least it is not traceable in the Bulletin International. It will be noticed that no strong wind from N.W. was felt at our stations at all. The barometer fell slowly during the 29th, and at midnight the decrease became more rapid and the gale increased and became more general.

Observatories.	Velocity, 30-40 Miles per Hour.		Velocity, Exceeding 40 Miles per Hour.				Velocity, Fell below 30 Miles per Hour.		Total No. of Hours, the Vel. above 30 Mls.	Maximum Velocity.			Remarks.
	Com-menced.	Direction of Wind.	Com-menced.	Direction of Wind.	Mean Vel.	Duration in Hours.	Ended.	Direction of Wind.		Hour.	Direction of Wind.	Velocity.	
Valencia -	8 p.m. (28th).	S.	5 a.m. (29th).	S.S.E.	50	28	9 a.m. (30th)	S.S.E.	37	8 a.m. (30th).	S.S.E.	64	At 10 a.m. the wind shifted to W.S.W., and the velocity having decreased from 60 to 23 miles an hour.
Armagh -	3 p.m. (29th).	S.S.W.	11 a.m. (30th).	W.	47	3	2 p.m. (30th)	W. by N.	23	Noon—2 p.m. (30th).	W.	46	—
Glasgow	8 p.m. (29th).	S. by E.	—	—	—	—	5 a.m. (30th)	S.	9	4 p.m. (30th).	S.S.E.	41	This velocity was only reached for one hour.
	Noon (30th).	S.E. by S.	—	—	—	—	5 p.m. (30th)	S. by E.	5				
Aberdeen -	Noon (30th).	S.	—	—	—	—	9 p.m. (30th)	S. by W.	9	7 p.m. (30th).	S.	38	—
Sandwick -	2 p.m. (30th).	S.S.E.	—	—	—	—	9 p.m. (30th)	S.E.	7	4 p.m. (30th).	S.S.E.	38	—
Falmouth -	Noon (29th).	S.S.W.	9 p.m. (29th).	S. by W.	48	20	8 p.m. (30th)	S.S.W.	32	2 p.m. (30th).	S.	52	—
Holyhead -	11 a.m. (29th).	S.	1 p.m. (29th).	S.	58	29	6 p.m. (30th)	S.	31	9 a.m. (30th).	S. by E.	72	—
Stonyhurst -	9 a.m. (30th).	S. by E.	9 a.m. (30th).	S. by E.	43	10	9 p.m. (30th)	S.	12	11 a.m. (30th).	S. by E.	47	—
Kew - -	10 a.m. (30th).	S.	—	—	—	—	Noon (30th)	S.	2	11 a.m. (30th).	S.	30	—
Yarmouth -	9 a.m. (30th).	S.	—	—	—	—	9 p.m (30th)	S. by E.	12	5 p.m. (30th).	S.S.E.	42	This velocity was only reached for one hour.

Dec. 30. Fig. 76 shows us that the isobars over Ireland ran nearly due north and south, the gradient from Portsmouth to Valencia being as much as 14. From Plate CXLVI. we see that the greatest force of the storm was confined to the south-western stations, Scotland having almost entirely escaped it. The weather throughout its continuance was very wet, the rainfall at Valencia exceeding *two inches* on the 29th. The sudden cessation of the storm at Valencia and Falmouth is a very remarkable feature of the gale.

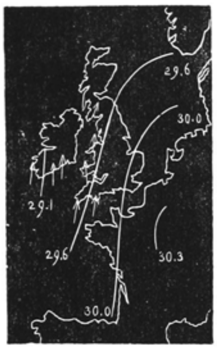

Fig. 76. Dec. 30.

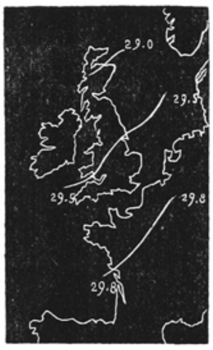

Fig. 77. Dec. 31.

Fig. 77, for the 31st, shows us greater uniformity of pressure than had prevailed on the previous day, while the rise of the barometer in the west had caused the wind to moderate and veer to west. At noon a slight fresh decrease set in at Valencia, which, however, was not serious, and the year closed with a great uniformity in barometrical readings, which were very low.

REMARKS.

Wind.—The following table shows the number of hours during which the wind reached the velocity of 30 miles or upwards per hour, irrespective of its direction, during the entire quarter:—

Observatory.	Oct.	Nov.	Dec.	Total.	Observatory.	Oct.	Nov.	Dec.	Total.
Valencia - -	93	138	158	389	Falmouth - -	78	121	238	437
Armagh - -	0	5	42	47	Holyhead - -	277	338	372	987
Glasgow - -	19	75	65	159	Stonyhurst -	2	63	38	103
Aberdeen - -	46	75	51	172	Kew - - -	0	0	43	43
Sandwick - -	262	290	118	670	Yarmouth - -	37	50	152	239

If we compare this table with the previous ones for the first three quarters of the year, pp. 31, 57, and 77, we see that the period was much more windy than either of the two summer quarters, though the number of hours during which high winds were registered still falls short of what was recorded from January to March, excepting at Aberdeen and Sandwick. It will be noticed that Valencia does not stand highest but only fourth on the list, which is headed by Holyhead, at which station the number of hours of strong wind registered was nearly exactly equal to the total number of hours recorded at the five observatories in Great Britain, Glasgow, Aberdeen, Falmouth, Stonyhurst, and Kew.

This result is mainly to be attributed to the fact that the gales were mostly northerly, and that they swept down the west coast of Great Britain, without affecting the Irish observatories at all in the same degree as Sandwick, Holyhead, and Falmouth. In fact, Holyhead, from its situation at the extreme north-western extremity of the Welsh mountain district, appears to feel with exceptional severity every gale which blows in St. George's Channel or the Irish Sea.

The total number of hours of wind, of the velocity of 30 miles or upwards, during the entire year at the eight original stations is as follows:—

Valencia - - -	1,584	Sandwick - - -	1,289
Armagh - - -	155	Falmouth - - -	1,374
Glasgow - - -	450	Stonyhurst - - -	272
Aberdeen - - -	392	Kew - - - -	202

These figures are sufficient to show what extreme caution is requisite in drawing conclusions as to the mean motion of the air over these islands from observations made at a few sparsely distributed stations.

Pressure.[*]—

October.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·132	—	30·605	22nd, 10 a.m.	29·367	16th, 8 a.m.	1·238
Armagh - -	30·069	+0·259	30·569	22nd, 11 a.m.	29·128	16th, 9 a.m.	1·441
Glasgow - -	30·008	+0·228	30·443	22nd, 11 a.m.	29·142	16th, 5 a.m.	1·301
Aberdeen - -	29·947	+0·162	30·382	*21st, 10 p.m.	29·103	16th, 10 a.m.	1·279
Falmouth - -	30·125	+0·115	30·574	22nd, 11 a.m.	29·443	16th, 3 p.m.	1·131
Stonyhurst - -	30·066	+0·250	30·494	22nd, 11 a.m.	29·251	16th, 10 a.m.	1·243
Kew - - -	30·071	+0·176	30·536	22nd, 9 a.m.	29·285	16th, 7 p.m.	1·251

* The barometer remained almost unaltered till 9 a.m. on the 22nd, when a fall set in.

Pressure was in excess at all the observatories, especially in the north. The range was considerable, reaching its maximum at Armagh. The highest reading was recorded at Valencia and the lowest at Aberdeen.

November.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·022	—	30·586	19th, 10 p.m.	29·305	22nd, 1 p.m.	1·281
Armagh - -	29·901	+0·019	30·494	20th, 10 a.m.	29·249	22nd, 9 a.m.	1·245
Glasgow - -	29·777	−0·092	30·390	20th, 11 a.m.	29·180	22nd, 6 a.m.	1·210
Aberdeen - -	29·673	−0·198	30·311	20th, 5 p.m.	29·099	4th, 4 a.m.	1·212
Falmouth - -	30·051	+0·167	30·571	18th, 9 a.m.	29·207	22nd, 6 p.m.	1·364
Stonyhurst - -	29·864	−0·021	30·379	20th, 4 p.m.	29·159	5th, midt.	1·220
Kew - - -	30·028	+0·061	30·571	18th, 10 a.m.	29·212	23rd, 10 a.m.	1·359

In this month readings at most of the stations were nearly at their average values. At Falmouth, however, there was an excess of nearly 0·2 in., and at Aberdeen a defect of a similar amount.

The range was nearly the same as in the preceding month, and was remarkably uniform in amount. The maximum reading was again reported from Valencia and the minimum from Aberdeen, while the greatest range was recorded at Falmouth.

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[*] For an explanation of these tables, see Part I. pp. 31 et seq.

December.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	Inches.	Inches.	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	29·803	—	30·589	5th, 11 p.m.	28·845	13th, 3 p.m.	1·744
Armagh - -	29·739	−0·145	30·677	6th, 1 a.m.	28·524	13th, 5 p.m.	2·153
Glasgow - -	29·712	−0·104	30·702	6th, 9 a.m.	28·340	13th, 8 p.m.	2·362
Aberdeen - -	29·670	−0·158	30·645	6th, 10 a.m.	28·259	13th, 10 p.m.	2·386
Falmouth - -	29·817	−0·247	30·512	5th, 10 p.m.	29·203	16th, 6 p.m.	1·309
Stonyhurst -	29·758	−0·104	30·666	6th, 11 a.m.	28·812	13th, 7 p.m.	1·854
Kew - -	29·804	−0·228	30·600	5th, 11 p.m.	28·952	16th, 9 p.m.	1·648

In this month there was a general deficiency of pressure which was greatest in the south of England. The range at the northern observatories reached a very large amount, exceeding 2·3 in. in Scotland, where both the maximum and minimum readings were recorded, the former at Glasgow, the latter at Aberdeen, at which station the absolute maximum of range was observed.

It may be interesting to recapitulate the facts relating to barometrical range for the entire year, the readings being taken from Table I. pp. 37–40, but reduced to sea level.

Observatory.	Maximum.	Date.	Minimum.	Date.	Range.
	Inches.	D. H.	Inches.	D. H.	Inches.
Valencia - -	30·605	Oct. 22, 10 a.m.	28·410	Jan. 28, 7 p.m.	2·195
Armagh - -	30·677	Dec. 6, 1 a.m.	28·437	„ 28, 11 p.m.	2·240
Glasgow - -	30·702	„ 6, 9 a.m.	28·340	Dec. 13, 8 p.m.	2·362
Aberdeen - -	30·686	April 28, 1 p.m.	28·259	„ 13, 10 p.m.	2·427
Falmouth - -	30·580	Feb. 13, 6 p.m.	28·670	Sept. 11, 11 p.m.	1·910
Stonyhurst - -	30·666	Dec. 6, 11 p.m.	28·712	Jan. 29, 2 a.m.	1·954
Kew - - -	30·600	„ 5, 11 p.m.	28·751	Sept. 12, 5 a.m.	1·849

This table shows us that both the maximum and minimum readings were recorded at the Scotch observatories, and that the range was greatest at Aberdeen and least at Kew.

Temperature.—

October.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia* - -	54·1	+1·2	73·4	9th, 2 p.m.	42·4	20th, 1 a.m.	31·0
Armagh - -	50·3	+1·1	69·0	9th, 2 p.m.	34·9	17th, 7 a.m.	34·1
Glasgow - -	48·3	+0·8	66·9	10th, 3 p.m.	39·9	27th, 4 a.m.	27·0
Aberdeen - -	47·1	+0·8	67·5	8th, 2 p.m.	29·6	27th, 5 a.m.	37·9
Falmouth - -	52·8	—	64·8	9th, 1 p.m.	40·1	28th, 7 p.m.	24·7
Stonyhurst - -	49·0	+0·8	71·0	9th, 2 p.m.	30·0	20th, 7 a.m.	41·0
Kew - - -	49·4	−0·2	73·0	10th, 3 p.m.	29·6	28th, 6 a.m.	43·4

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* The figures for comparison with the means for Valencia and Armagh are taken from Mr. Buchan's paper.

Temperature was therefore nearly at its normal amount for the month at all the stations. A slight excess is noticeable in the south and west. The maximum reading was recorded at Valencia and the minimum at Kew, where also the greatest range was noticed.

November.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	50·1	+3·3	57·4	18th, 1 p.m.	35·7	11th, 7 a.m.	21·7
Armagh - -	43·1	+0·7	58·6	18th, 2 p.m.	29·5	30th, 8 a.m.	29·1
Glasgow - -	40·6	+0·3	55·9	18th, 6 p.m.	24·1	24th, midt.	31·8
Aberdeen - -	40·0	+0·1	58·8	2nd, 1 p.m.	24·4	29th, midt.	34·4
Falmouth - -	48·7	—	56·7	3rd, noon.	36·3	24th, 8 a.m.	20·4
Stonyhurst - -	42·2	+1·1	53·0	15th, 5 p.m.	27·4	30th, 10 p.m.	25·6
Kew - - -	43·6	+1·2	58·7	15th, 3 p.m.	25·7	12th, 7 a.m.	33·0

This table shows an excess of temperature exceeding 3° at Valencia. The maximum reading was recorded at Aberdeen, the minimum at Glasgow. The greatest range was reported from Aberdeen.

December.

Observatory.	Mean.	Difference from Average.	Maximum.	Day and Hour.	Minimum.	Day and Hour.	Range.
	°	°	°	D. H.	°	D. H.	°
Valencia - -	43·9	−2·4	55·0	18th, 2 p.m.	27·7	27th, 11 p.m.	27·3
Armagh - -	37·4	−4·0	55·2	18th, 4 p.m.	20·7	28th, 6 a.m.	34·5
Glasgow - -	35·8	−4·3	53·0	18th, 4 p.m.	13·0	28th, 7 a.m.	40·0
Aberdeen - -	35·7	−2·8	47·9	13th, 3 p.m.	20·0	2nd, 9 a.m.	27·9
Falmouth - -	42·6	—	55·2	16th, 6 p.m.	26·0	26th, 11 p.m.	29·2
Stonyhurst - -	36·7	−2·8	54·6	18th, 6 p.m.	? 14·3	28th, 9 a.m.	? 40·3
Kew - - -	38·8	−0·2	55·4	16th, 10 p.m.	20·3	29th, 3 a.m.	35·1

December was a cold month, especially in the north, the mean for Glasgow being more than 4° below its normal amount. At Kew, however, the depression of temperature was insignificant.

The maximum reading was registered at that observatory and the minimum at Glasgow. The greatest range was recorded at Stonyhurst. It will be noticed that the minimum reading 14·3° is marked as doubtful on the table on p. 39, whereas on Plate CXLV. a reading of 13·5° is entered. The reason of this discrepancy is that the thermogram is so indistinct at the epoch of the minimum reading that it cannot be tabulated by means of the ordinary glass tabulating scale. It is, however, sufficiently clear to be reproduced by means of the pantagraph. The reading of 13·5, which agrees within 0·1° with the minimum for the month as published by the College, has, however, not been entered in Table I., as it has not been obtained by direct measurement from the photographic curve.

The following table gives the extreme readings and the range for the entire year at each observatory:—

Observatory.	Maximum.	Date.	Minimum.	Date.	Range.
	°		°		°
Valencia - -	82·3	Aug. 27, 3 p.m.	27·7	Dec. 27, 11 p.m.	54·6
Armagh - -	78·1	July 17, 4 p.m.	20·7	„ 28, 6 a.m.	57·4
Glasgow - -	79·0	„ 17, 3 p.m.	13·0	„ 28, 7 a.m.	66·0
Aberdeen - -	78·3	Aug. 25, 2 p.m.	20·0	„ 2, 9 a.m.	58·3
Falmouth - -	78·4	July 18, 2 p.m.	26·0	„ 26, 11 p.m.	52·4
Stonyhurst - -	83·2	Aug. 28, 3 p.m.	14·3	„ 28, 9 a.m.	68·9
Kew - - -	88·3	July 22, 2 p.m.	20·3	„ 29, 3 a.m.	68·0

The absolute maximum was therefore recorded at Kew and the minimum at Glasgow. The greatest range is reported from Stonyhurst, the figure for which station is certainly rather too low than otherwise, as explained above.

The comparison of the five-day means for Kew with those for Greenwich, given by Dove, is as follows:—

Dates.	Variation.	Dates.	Variation.	Dates.	Variation.
	°		°		°
Sept. 28–Oct. 2 -	+ 5·7	Oct. 28–Nov. 1	− 1·6	Nov. 27–Dec. 1	−4·1
Oct. 3– 7 -	+ 1·3	Nov. 2– 6 -	+ 2·0	Dec. 2–6 -	−6·7
„ 8–12 -	+ 7·6	„ 7–11 -	− 4·5	„ 7–11 -	+1·1
„ 13–17 -	− 0·6	„ 12–16 -	+ 7·2	„ 12–16 -	+4·4
„ 18–22 -	− 5·6	„ 17–21 -	− 2·3	„ 17–21 -	+4·1
„ 23–27 -	− 4·8	„ 22–26 -	+ 0·8	„ 22–26 -	−2·6
				„ 27–31 -	−1·8

From this it appears that the variation from the average was very irregular, and that the cold period at the end of the year, during which the minimum readings were recorded at five of the observatories, did not depress the five-day mean nearly to the same extent as the weather during the latter half of October and at the beginning of December.

APPENDIX.

NOTES ON EASTERLY GALES, BY ROBERT H. SCOTT.

The East coast of Great Britain monopolizes nearly half the casualties recorded in the Wreck Returns as occurring on our shores. The actual figures for 1868 are as follows:—

East coast	823	Irish coast	189
South „	202	Isle of Man	22
West „	427	Lundy Island	16
N.W. coast of Scotland	64	Scilly Isles	4

We find, however, that notwithstanding this pre-eminence of the coast of the North Sea as regards the actual number of wrecks, the number of lives lost in the Irish Sea and St. George's Channel is more than double the number lost on any other part of the coast. The reason of this apparent discrepancy between the two statements is evident when we consider the contrast between the classes of vessels navigating the respective seas. The loss of a single ship, such as the "Royal Charter" or the "Pomona," entails a far greater loss of life and property than the foundering of a score of colliers. The craft frequenting our East coast are for the most part of small tonnage; and we learn from the Wreck Return already quoted that for the six years ending in 1868 more than half the casualties occurred to "the unseaworthy, overladen, and ill-found vessels of the collier class, chiefly employed in "the coasting trade."

To vessels such as these an easterly gale, bringing with it as it does a heavy sea on the exposed coast of Norfolk or of Northumberland, is fraught with extreme danger. Accordingly, if early intelligence could be given of the proximity of such a gale, the benefit to our fishermen and to the coasting trade would be immense, and it is mainly in their interest that the service of telegraphic weather intelligence has been instituted.

Unfortunately, however, the character of these polar gales is even less understood than that of any others which visit our shores. It is well known that the barometer gives little warning of their approach at the spot where they burst; and whether or not we admit with Dove, that the suddenness of their appearance is attributable to the circumstance that the cold polar current appears first in the lower strata of the atmosphere, the fact remains incontrovertible that easterly gales usually come on us almost without notice.

With the view of attempting, by the collection of statistics of these gales, to throw some light on the question of their origin and history, I have extracted from the daily weather reports all the cases in which storms, blowing from any point between north and east-south-east, have been recorded during the time for which daily charts have been drawn. This period comprises in all nearly three years, embracing the last three months of 1864, part of January 1867, and the time from June 1867 to March 1870. The autumn of 1864 and the first few days of 1867 were taken because the charts had already been drawn for the purposes of other investigations.

The storms have not in general been traced beyond the coasts of France and Holland, owing to the absence of telegraphic information from the entire area of North Germany.

The force of wind assumed to represent a gale is 8 (Beaufort scale), being the next lower figure to that fixed as the limit for "stress of weather" in the Wreck Return.

The following list shows, in chronological order, the several storms which are discussed, and the localities in which they were felt. The Roman numerals show the order in which they will be found in the subsequent discussion:—

1864.

Oct. 3–5.	E. to E.S.E. in the English Channel, extending to St. George's Channel on the 5th	(VI.)
Oct. 20.	E. in north of Scotland	(XXIV.)
" 21.	N.E. at Nairn and in south of Ireland	
" 22.	N.E. in Ireland, Wales, and the south of Scotland, E at Scarborough	
" 23.	N.E. in Scotland	
Dec. 17–19.	E. on the east coast of England, extending to Holyhead on the 19th	(I.)
" 22.	E. on the east coast of England	

1867.

Jan. 6, 7.	E.S.E. at all the south-western stations	(XVI.)
" 9.	N. at Aberdeen	
" 10.	N. on the east coast of England	
Nov. 16.	N. at Scarborough, N.E. in the west of England	(VII.)
" 17.	N.E. at Scarborough, Holyhead, and in the Channel	
Dec. 1.	N. in Ireland, and in the west and north of England	(XX.)
" 2, 3.	N. to N.N.E. generally, except in the north of Scotland	
" 4.	N.N.E. on east coast of England	
" 5.	N. and N.N.E. in Ireland and at Liverpool	
" 6, 7.	N.N.E. in England generally	

1868.

April 8.	N.E. at Ardrossan, Holyhead, and Scarborough	(XII.)
" 9.	N.E. in England generally, and at Cape Clear	
May 5.	N.E. at Cape Clear	(II.)
" 6.	E. in English Channel	
July 24, 25.	Easterly in English Channel	(XXV.)
Sept. 25.	E. at Cape Clear and Weymouth	(VIII.)
" 26.	E. at Holyhead and on east coast of England, N.E. at Valencia	
Oct. 1.	N.E. in Scotland and at Holyhead	

1869.

March 13, 14.	E. in English Channel, extending to Yarmouth	(IX.)
„ 19.	N.N.E. at Valencia, E.N.E. at Holyhead	(XIII.)
„ 20, 21.	N. in the south-east of England	
March 28.	N.E. in north of England, N. at Penzance and in Ireland	(XXI.)
„ 29.	N.N.E. on west coast of England, N.E. to E. on south-east coast of England	
„ 30.	N.E. to E. in the south and west of England	
April 29, 30.	E.N.E. to E.S.E. in Ireland and the south of England	(III.)
May 4.	E.N.E. at Holyhead	(X.)
„ 7, 8.	E.N.E. in Ireland	
„ 14, 15.	E. in the English Channel, extending to Holyhead and Yarmouth on the 15th	(IV.)
„ 27–29.	E.N.E. to E. at Holyhead and in Ireland; E. in south-east of England on the 29th	(XI.)
June 16.	N.E. on the coast of Yorkshire	(XVII.)
Aug. 29, 30.	N.N.E. in the north of England and of Ireland, E. in the English Channel on the 30th	(XVIII.)
Oct. 16, 17.	N.E. in Scotland, N. in south of Ireland	(XIX.)
„ 19.	N.E. in the north of England, N. in St. George's Channel and in Ireland	
„ 26, 27.	N. at Scarborough, Holyhead, and Penzance	(XXII.)
„ 28, 29.	N. to N.N.E. on the east and west coasts of England	
Nov. 30.	N.N.E. on the coast of Wales	(XIV.)
Dec. 1, 2.	N.N.E. on the coast of Wales, N. at Scarborough	
„ 4.	N. at Holyhead, E.N.E. at Scarborough	
„ 5.	N. to N.E. in the west of England and Wales	
„ 23–25.	N.N.E. at Holyhead, and also at Valencia and Pembroke on the first of the three days	(XXIII.)

1870.

Feb. 9.	E. at Holyhead and Yarmouth	(V.)
„ 12–14.	N.E. to E. in Ireland and England generally, most severe on the south-east coast	
March 3.	N.E. in Ireland, extending to Holyhead and Scarborough	(XV.)
„ 4, 5.	N.E. on the east coast of England, N.N.E. at Holyhead	

The storms are accordingly 25 in number. Most of them, however, consist of more than one disturbance, as will be seen in the subsequent analysis.

The most remarkable fact in the foregoing list is the great prevalence of these gales in the spring of 1869, eight of them, nearly one third of the entire number, having occurred between the beginning of March and the end of June in that year.

The most cursory examination of the materials was sufficient to show that the consideration of the storms, in the chronological order of their occurrence, would teach us very little about them. The respective localities in which the gales were felt was another possible, but not very promising, basis of discussion which presented itself. It will be seen how frequently the coast of the English Channel and the stations of Holyhead and Scarborough are visited by them.

It appeared ultimately to be the most practically useful plan to treat of the gales with reference to their motion of translation over the area of these islands and the adjacent coasts of the continent. This motion of translation depends on the direction and rate of the advance of the area of relatively diminished barometrical pressure which is the invariable concomitant of a storm. The wind blows in accordance with Buys Ballot's law, and consequently whenever it is easterly the barometer at southern stations must read lower than at northern, and the velocity of the wind must depend on the difference of readings over a given distance, or on the "gradient," as explained in the Introduction (p. viii.)

The most obvious cause of an easterly storm will be the passage of a barometrical depression to the south of these islands, say across Spain, but many of the gales enumerated have occurred with storm paths widely differing from that which has been just instanced.

On the whole, it has been decided to make six distinct groups, according to the direction of advance of the principal depression. These groups are,—

A. Depressions advancing eastwards over Spain (5 in number).
B. Depressions advancing towards E.S.E., skirting our south-west coasts, and moving to the Bay of Biscay (6 in number).
C. Depressions advancing along the English Channel (4 in number).
D. Depressions advancing from N.W., across England to Holland (4 in number).
E. Depressions advancing from N. or N.N.E. (4 in number).
F. Two cases different from any of the foregoing groups.

A brief analysis of the weather for each day is given, having especial reference to the distribution of barometrical pressure and the motion of the air; but as the object of the inquiry has been to investigate easterly winds, comparatively little attention has been paid to winds from other points of the compass.

CLASS A.—DEPRESSIONS ADVANCING EASTWARDS OVER SPAIN.

No. I.

1864. Dec. 12.—The isobaric lines ran nearly due N. and S., pressure ranging from 29·93 at Heligoland to 29·29 at Valencia. A decrease of 0·2 in. had occurred over the Bay of Biscay. The gradient from Dover to Valencia was 4. A heavy southerly gale had passed over most of our stations, but this morning light to moderate southerly winds were reported, with a very uniform temperature.

Dec. 13.—The decrease of pressure in the south-west continued to make steady progress, and the barometer at Valencia fell as low as 29·18. A corresponding increase took place over Central Russia, its influence extending to Norway and Scotland. The gradient from Aberdeen to Valencia thus became 5·5.

The wind having increased to a strong southerly gale on the Cornish coast backed to S.E. at most stations, in accordance with the change of direction of the gradient, and was moderate, to fresh, in force.

In the evening a sudden depression, with a severe gale, advanced to the coast of Portugal, the minimum reading of the barometer being registered at 10·15 p.m. at Lisbon.

Dec. 14.—Pressure continued to increase in Russia, and a similar change took place at all our stations, being most marked in Ireland. Readings thus became very uniform over these islands, the average being about 29·80. The depression had, however, advanced eastwards over Spain, and affected the barometers in France, so that the gradient from Weymouth to Rochefort became 6·3.

The wind drew into East, still remaining moderate over these islands, but heavy gales from that quarter were felt in Spain and in the Gulf of Lyons.

Dec. 15.—The Spanish depression was in process of being filled up, but a large area of low readings existed over the south of France, while the high pressures advanced westwards from Russia. In these islands the barometer remained nearly steady.

The wind backed further to E.N.E., and began to freshen at Yarmouth and in France.

Dec. 16.—The barometer rose rapidly in southern France, while a slight fall is noticed off our western coasts, and the gradient from Aberdeen to Valencia again became 5·5. The wind veered to E.S.E. over the North Sea, blowing generally fresh, and even with the force of a gale at Yarmouth and Heligoland.

Dec. 17.—A general increase of pressure took place, which was greatest in Ireland. Readings varied from 30·21 at Nairn to 29·73 at Rochefort. The winds backed again to N.E. at the western stations, and to E. at those on the east coast of England, where a heavy gale was felt, which extended during the day to Holyhead and Leith.

Dec. 18.—The high pressures in the North gave way, while the barometer showed a tendency to rise at southern stations, so that considerable uniformity in readings again resulted, and winds fell light veering to south.

Dec. 19.—There was little to report, except that the wind freshened from S.E. over the North Sea, and a thick fog appeared in the Channel.

Dec. 20.—A slight depression had advanced to Penzance, and readings were already recovering in Ireland. The gradients were not very steep, only 4·7 from Yarmouth to Penzance, and 6·5 from Rochefort to the same station.

The winds were light, but determined in their general direction by the conditions of pressure; they were freshest over Brittany, where they blew from W.

Dec. 21.—A rapid rise of the barometer ensued, especially in the south-west of England, and readings were remarkably uniform, about 30·05 in England; however, in Scotland they were about 0·2 in. higher, and the gradient from Nairn to Scarborough was 6·2. The wind at the northern stations drew into N.E. and freshened at Aberdeen.

Dec. 22.—The rate of increase slackened in the west, but was considerable along the east coast, so that the gradient from Shields to Portsmouth became 6, and the wind freshened to a strong gale from E. at Yarmouth.

Next day there was a general increase in pressure, and the gale died down, having only been felt at Yarmouth and in London.

No. II.

1868. May 3.—A general diminution of pressure was noticed, affecting all our stations, and amounting to 0·51 in the north of Scotland; it was least in Ireland, and in Norway a recovery was reported;

at Nairn the reading was 29·56, while it was 29·99 at Valencia, and 30·40 at Skudesnaes. The gradients to Nairn were 8 from the latter and 5·5 from the former station.

The wind was light in the south of England, but fresh westerly in Scotland, increasing to a slight gale at Aberdeen and Glasgow during the day. In France and the south of Ireland, moderate easterly winds set in.

May 4.—The northern depression reached the coast of Norway, causing stiff westerly gales. The absolute minimum reading was registered at Christiansund. The rise in the barometer in Scotland was very rapid, while a considerable fall took place over Spain, and the gradient from Greencastle to Brest became 4.

The N.E. wind became more general and freshened.

May 5.—The steady increase in the north made further progress, and at Skudesnaes the rise was 0·48 in. Readings remained steady in the south, except that the centre of the depression had now advanced to Rochefort, but the amount of rarefaction in it had lessened. Pressure decreased from 30·34 at Nairn, and 30·22 at Helder, to 30·01 at Cape Clear and at Skudesnaes, and 29·73 at Rochefort. The gradient from Greencastle to Rochefort became 4·5.

The wind freshened from the eastward in the south, and a slight gale from that point was reported from Cape Clear, Falmouth and London having an increasing easterly breeze.

May 6.—The southern depression disappeared, and readings in the north gave way, reducing the gradients slightly. The wind gradually died down, having blown a gale from E. all night long on the south coast of England.

No. III.

1869. April 28.—Pressure at the Scotch stations was extremely high. Readings ranged from 30·67 at Aberdeen to 29·95 at Brest, accordingly the gradient between these two stations was 6·5. A slight decrease had made its appearance at Corunna.

Easterly winds were universally prevalent, having freshened during the night at the southern stations.

Throughout the day there was little change in pressure, but the wind increased from the eastward at all our stations, reaching the force of a strong breeze at Glasgow, Valencia, and Falmouth. At Glasgow it commenced at 9 a.m. and lasted till 7 p.m. At Valencia it did not begin till noon, and it lulled at 8 p.m. At Falmouth, after some stiff gusts between 1 and 3 p.m., the wind increased again at 10 p.m. and lasted till noon next day, with an average velocity of 36 miles an hour.

April 29.—Pressure on the whole was very slightly changed, and the gradients were almost unaltered; however, the depression already noticed had advanced to the south of France.

A stiff easterly gale was blowing at Holyhead and at all our south-western stations. The velocity moderated at noon at Falmouth, but increased again in the evening, and the wind blew with nearly equal violence to that noticed on the previous night, from 11 p.m. till noon on the 30th.

April 30.—A general decrease occurred in the north, where readings fell to 30·36, and the gradient from Aberdeen to Brest was reduced to 4·6. The winds accordingly veered to E.S.E., continuing to blow hard in the south-west, but finally dying down during the day.

No. IV.

1869. May 13.—Pressure was generally high, especially over the Irish Sea, ranging from 30·34 at Ardrossan to 29·72 at Biarritz. An increase varying from 0·2 to 0·3 had occurred at all our northern stations, accompanied by a decrease of similar amount over Spain. The gradient from Holyhead to Rochefort was 5.

The wind was easterly and moderate at most stations; however, at Toulon an E. gale was reported, and in Scotland light airs from N.W. were felt.

During the day the depression advanced eastwards, and the wind at all our observatories veered to E., increasing on our south-western coasts, and reaching the force of a gale at Falmouth at 5 a.m.

May 14.—The greatest fall was 0·28 at Brest, while a slight rise occurred in the north. The extreme readings were respectively 30·38 at Aberdeen, and 29·66 at L'Orient. The gradient from Scarborough to Brest became 8·5.

The wind had increased to a gale all along the Channel, blowing from 5 a.m. till 2 p.m. at Falmouth with an average velocity of 43 miles an hour. At Kew a strong breeze began at 8 a.m. and lasted eight hours, the velocity being 34 miles an hour. At Yarmouth the commencement was at noon, and the direction E.N.E.

May 15.—A general diminution of pressure took place, which was least rapid in the south-west, so that the gradient from Scarborough to Brest decreased to 7. The easterly gale accordingly died down, first at Falmouth and subsequently at the eastern stations.

No. V.

1870. Feb. 5.—A slight depression had appeared at Valencia on the 4th with freshening southerly winds, while at Sandwick, Oxö, and Hamburg a gale from E.S.E. had begun, lasting, however, only through the night at the last-named station.

This morning a recovery is noticed in the Irish reports, and pressure over these islands is very uniform and rather low, about 29·60. It is, however, rising over the Gulf of Finland, and the gradient from Oxö to Wick is 10.

The gales from E. are still reported at Oxö and Skudesnaes in the south of Norway.

On this day the s.s. "Weser" in lat. 49° N. and long. 26° W. lay to for five hours in a heavy westerly gale; and Captain M. Murphy in the "Tarifa" reports a very heavy gale veering from S.W. to W. and W.N.W. in lat. 51° N., long. 24° W., during which, at 7.30 p.m. Greenwich time, his barometer showed the extraordinarily low reading of 27·40 in.! The mean of the 24 hourly readings at St. Petersburg for the 5th was 30·99 in., so that the difference of pressure between that station and the position of the "Tarifa" amounted to *three inches and a half!*

About 2 p.m. the wind at Valencia backed to S.E., increased, and blew a heavy gale for 24 hours, and towards midnight the gale commenced from the same point at Holyhead, Armagh, and Sandwick, and a fresh breeze from S. was felt at Falmouth. At Armagh the gale only lasted for 13 hours, but at Sandwick for three days.

Feb. 6.—A rapid rise of the mercurial column at all the eastern stations culminated in a reading of 31·17 in. at St. Petersburg. This combined with a further decrease in Ireland, where readings were nearly 2 inches lower (29·24 at Valencia) produced very high gradients at 8 a.m. That from Oxö to Greencastle was 13, and that from Rochefort to Valencia 8·8.

The wind at southern stations moderated during the day, though still blowing very fresh; however, in the north a furious S.E. storm came on. This commenced at Aberdeen at 7 a.m., lasting 21 hours. It continued all day long, with more or less force, in the Orkneys, in Southern Norway, and at Hamburg. At Glasgow it commenced as a strong breeze at noon and lasted four hours. At Stonyhurst a similar velocity was recorded for six hours from 4 p.m., and at Yarmouth the velocity of 30 miles an hour set in at 3 p.m. and *lasted nine successive days.*

The barometrical dip passed out to the eastward over Aberdeen about midnight, but does not seem to have reached Norway at all, while the southern portion of the depression increased in intensity, readings falling quickly at the Channel stations and in France.

Feb. 7.—An area of low readings is shown off the entrance of St. George's Channel, but gradients became less steep, as a recovery is noticeable in Ireland. That from Oxö to Greencastle was 9·4, and from Rochefort to Penzance 6·6.

The winds moderated and backed to E. during the day, except at Aberdeen, where the gale recommenced at 3 p.m. and blew for 38 hours, still continuing with very great violence in the Orkneys and Norway and at Yarmouth.

Feb. 8.—A further decrease over St. George's Channel with an increase in Scotland and Norway are reported. The depression lies slightly to the northward of its position on the preceding day. The highest reading in our vicinity is at Oxö, and is 30·47, while that at Pembroke is 29·31, giving a gradient of 9·7 between these stations.

The storm raged from points between E. and S.E. all along our east coast, while at Valencia and Falmouth the wind had moderated and drawn to N.W. and W. respectively, so that the circulation round the central area was thus preserved. At Holyhead an easterly gale began about noon, lasting for 38 hours, and at Stonyhurst the wind was fresh from N.E. throughout the night. A westerly gale had begun in France, while in Norway the force of the wind moderated.

Feb. 9.—The district of greatest reduction of pressure is found in the south of France, with an easterly gale at Toulon. A general increase of pressure occurred at all our stations, and amounted to nearly half an inch in Scotland. The depression still existed off Pembroke, but had to a great extent become filled up. The gradient from Nairn to Pembroke was 7.

The wind was generally easterly, and the gale had moderated, except at Yarmouth and Holyhead; however, even at Yarmouth there was a temporary lull during the early morning hours.

At 8 a.m. the storm recommenced at the last-named station, and at Falmouth it set in at 3 p.m., blowing stiffly from E., backing to N.E., and lasting with little intermission for five days.

Feb. 10.—The depression off Pembroke was no longer traceable, as a rapid rise occurred in that district. Readings were still lowest in the extreme south, though even there they averaged about 29·80 in. The gradient from Ardrossan to L'Orient was 6·3.

The winds were generally easterly, but a velocity of 30 miles was only reported from Yarmouth and Falmouth.

Feb. 11.—Barometrical equilibrium was still further established over these islands, the gradient from Ardrossan to L'Orient being reduced to 5. However, a depression began to show itself off the coast of Portugal, causing the winds to freshen from the eastward over France during the day.

The winds over these islands were light in the north and moderate in the south, blowing with the force of a gale only at Yarmouth; however, at 8 a.m. the velocity of 30 miles an hour was regained at Falmouth.

Very hard frost was reported at southern stations; the thermometer reading at Paris being 24° lower than that at Thurso.

Feb. 12.—The new disturbance advanced in a north-easterly direction, while readings over Norway and Scotland became very high, producing a gradient of 6·6 from Leith to Rochefort. The reports showed a progressive diminution from 30·77 at Oxö and 30·65 at Nairn to 29·54 at Biarritz.

The easterly winds increased to a gale in the Bay of Biscay, and while at Yarmouth and Falmouth the storm continued to blow with considerable violence, it set in at Holyhead and Valencia about noon, lasting till next morning. At Kew the breeze freshened about noon, but did not settle to blow strongly until after midnight.

The conditions of temperature remained unchanged.

Feb. 13.—The depression reached the Pyrenees, where the barometrical readings were about 29·25, while 30·81 was registered at Skudesnaes. The gradient from Ardrossan to Rochefort became 9·3.

A very heavy N.E. gale swept over all but the extreme northern stations during the day, with heavy snow showers; even at Stonyhurst, Armagh, and the Scotch observatories a marked increase of velocity is noticeable. At Yarmouth the registered rate of motion exceeded 60 miles an hour throughout the entire day.

Temperature in the south began to rise.

Feb. 14.—A slight decrease was noticed at our stations, and the gradients were somewhat reduced, still, however, remaining very steep in the Channel. The depression moved apparently southwards towards Barcelona, and gradually became filled up.*

The gale still continued at all the English stations, but moderated in Ireland and in the north.

Weather gradually became warmer, and the gales died down according as the atmosphere regained its equilibrium as regards pressure.

Remarks on Class A.

No. I., Dec. 11, a southerly gale had passed over our stations, subsequent to which the barometer began to rise, firstly over Russia, and afterwards over Norway and Scotland, while a steady fall occurred off our south-west coast, causing strong southerly winds at the entrance of the Channel. This wind backed to S.E. and moderated according as pressure became greater in the north.

The barometer continued to fall over Spain, and on the evening of the 13th a serious depression, of small area, passed over Portugal, and advanced eastwards next day. It caused heavy easterly gales in Spain and the south of France. In these islands the wind backed further to E.N.E. and began to freshen. For a week afterwards the barometer was unsteady, and occasional easterly gales were felt on the east coast of England.

No. II. was a slight local gale, confined to our southern coasts. It was due to the advance of a barometrical depression over Spain, and throughout its continuance pressure was much less in Norway than in Scotland. At no time were gradients high.

No. III. offers a contrast to the case just noticed. The gradients for E. winds were very high during the whole period, but the actual disturbance which gave rise to the gale was a very slight depression appearing at Corunna and moving along the north of Spain.

No. IV. was a simple case of a depression advancing to Spain and causing easterly gales in these islands, which ceased when the barometer began to fall in the north.

No. V. was a most remarkable series of gales.

Pressure remained unusually high over Russia throughout the period.

The storm experienced by the "Weser" and "Tarifa" in the Atlantic, on February 5, apparently reached our shores on the 6th; but while the westerly wind did not affect us at all, a very heavy S.E. gale had begun on the east coast of the North Sea, and extended to the north of Scotland.

This gale seems to have been caused by the advance *westwards* of the high pressures prevailing over Russia, which increased the gradients and consequently the force of the wind. Another effect of this advance was to stop the eastward motion of the depression which was coming on from the Atlantic, and to cause it to hang off the entrance of the Bristol Channel, while easterly gales were felt on its northern edge at Yarmouth and Holyhead.

On the 9th and 10th the barometer rose to a great height over these islands, while there was scarcely any cessation in the easterly gale at our southern stations. On the 12th a fresh depression appeared in Portugal and advanced steadily to the Pyrenees, where it gradually became filled up. To this latter disturbance were due the very severe easterly gales which swept over the south of the United Kingdom between the 12th and the 15th of February.

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* Between the 13th and 14th of February the phenomenon of red rain was observed at Genoa, Moncalieri, and several other places in Italy, during a south-east gale. The occurrence forms the subject of a paper by M. H. Tarry, Bulletin de l'Association Scientifique de France, 1870, pp. 302, 311. M. Denza, director of the observatory of Moncalieri, also notices it in his Bulletino Meteorologico, Vol. V., No. 2, and in the Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Vol. V., No. 8.

Of these storms, Nos. I. and V. present some points of resemblance, in that on each occasion, prior to the commencement of the gale, the barometer had risen to a great height over Russia, and this change extended westwards, as if the air were flowing out westwards from the region of excessive pressure.

The contrast between Nos. II. and III. is perhaps to be accounted for by the fact that the former occurred when the atmosphere was in a much more disturbed condition than the latter.

CLASS B.—DEPRESSIONS ADVANCING TOWARDS E.S.E., SKIRTING OUR SOUTH-WEST COASTS, AND MOVING TO THE BAY OF BISCAY.

No. VI.

1864. Oct. 1.—Pressure had been high and very uniform on the preceding day. This morning a slight depression appeared off the west coast of Ireland, accompanied by a steady recovery in Norway. Readings ranged from 30·21 at Scarborough to 29·84 at Rochefort, giving a gradient of 3·7 between these stations.

The winds drew to S.E., and began to freshen at the south-western stations.

Oct. 2.—An increase of pressure is noticed at all British stations, and amounts to 0·25 in the west of Ireland, while readings over the Bay of Biscay became still less. The extreme readings were 30·39 at Aberdeen and 29·76 at Rochefort, and the gradient from Scarborough to the latter station was 6·3. The centre of depression on the French coast lay near Biarritz.

The wind backed to E. in the Channel, and freshened to a gale at Plymouth at 8 a.m., increasing and becoming more general during the day, but not extending to Ireland, where the direction was still S.E. and the force moderate.

Temperature continued uniform and high with fine weather.

Oct. 3.—The mercury continued to rise over these islands and Norway, while a brisk motion in the same direction is noticed over the Bay of Biscay. These changes caused pressure to attain a considerable height in Scotland and over the North Sea, 30·53 at Aberdeen, but the gradient from Scarborough to L'Orient remained 7.

The easterly gale moderated in the Channel.

Oct. 4.—An extensive reduction of pressure is reported, reaching a maximum in the south-west. The central area of depression was situated over the Bay of Biscay, while readings in the north-west were unchanged. Accordingly the gradient from Scarborough to L'Orient increased slightly to 7·5.

The winds had veered again to E.S.E., blowing a strong gale at all our southern stations, with a fresh reduction of temperature. The gale was not much felt over the Bay of Biscay, but a severe storm from the eastward blew in the Gulf of Lyons.

Oct. 5.—The high pressures in Norway began to give way, and as this change affected our stations on the coast of the North Sea, the gradients were reduced and the winds moderated, especially in the Channel. The gale lasted longest in Ireland.

No. VII.

1867. Nov. 13.—After a succession of light easterly winds, with uniformly high pressures, dry weather, and fog, there was on this day a general decrease, exceeding 0·3 in. in Scotland. This brought readings to about their normal amount in these islands; they were highest in central Europe. In Norway a stiff westerly gale was reported, which lasted all day. In France the wind was generally easterly, while on our west coasts it drew into S.E. and S.W.

Temperature was high in Ireland, and fog very prevalent along the east coast of England.

Nov. 14.—The barometer continued to fall, especially in the south of England, but the absolute minimum (29·51) was in the south of Ireland, while at Heligoland the reading was 29·99. The gradient from Helder to Roche's Point was 4.

The wind continued light southerly in England, but veered to W.N.W. in Ireland.

Nov. 15.—A slight recovery in barometrical readings occurred in the north, while the decrease in the south was still reported; so that the area of depression lay over France, but the gradients were not steep.

During the day the changes just mentioned made further progress respectively, and the wind began to veer to N.E.

Nov. 16.—A brisk rise of about 0·4 in. had taken place in the North, making the extreme reading 30·16 at Nairn, while 29·29 was reported from L'Orient. The gradients to L'Orient were accordingly 7·3 from Nairn, and 8·1 from Valencia.

Temperature fell quickly in the north and east, and the winds freshened from N. and N.E., gales having been reported during the night from the former point at Scarborough, and from the latter point at Penzance.

This morning it was blowing a gale from E.N.E. at Holyhead, while the easterly winds in the Channel were fresh, and increased to a gale at Penzance by 2 p.m.

Nov. 17.—The depression had advanced to central France, while over these islands the barometer rose generally and uniformly. The gradients to Rochefort remained still somewhat steep, viz. 7 from Nairn, and 7·8 from Valencia.

The wind freshened to a heavy easterly gale at all our southern stations and in France.

During the day the recovery of pressure extended to France, where readings regained their normal amount, and the storm died down.

No. VIII.

1868. Sept. 24.—Barometrical readings were remarkably uniform, and rather low, the minimum in these islands being at Scarborough. A slight general decrease had occurred, which amounted to 0·54 at Skudesnaes, where the reading was 29·29.

The winds on our east coast were light from N.W., being influenced by the low pressures prevailing over Norway, while in the extreme west they were light from N.E.

During the day there was a slight decrease in the south, with a rise in the north, and at midnight the barometer began to fall rapidly at Valencia and Falmouth, while a strong easterly breeze set in at the latter station about midnight and lasted till 8 a.m.

Sept. 25.—A well-marked area of depression appeared off the entrance of the Channel, the fall having amounted to 0·5 in. at some stations. The range of readings was from 29·71 at Helder to 29·21 at Cape Clear. The gradient from Leith to Cape Clear thus became 7.

A slight N.E. gale began at Valencia at 8 a.m., and lasted on the south coast of Ireland till the afternoon. The minimum reading passed Falmouth at noon, where the wind veered to S.W. and blew a stiff gale for some hours. At Rochefort it was also blowing hard from the same point at 2 p.m. The barometrical hollow reached Kew at 4 p.m.

During the night a fresh depression advanced to the north of Ireland, passing Armagh at 2 a.m. and Stonyhurst at 4 a.m., but being scarcely noticeable elsewhere. It caused a S.W. gale at Valencia for a few hours, from 2 a.m., which backed to E. and lulled by 8 a.m.

Sept. 26.—The southern depression had apparently passed out to the eastward and become filled up, without affecting readings in Norway or Germany. In its passage the N.E. gale had extended to Holyhead, Scarborough, and Yarmouth.

This morning the lowest readings were again in the west, the report from Paris showing 29·87, while that from Valencia was 29·24. The gradient from Scarborough to Valencia was 5·1, and from Rochefort to the same station 4·9.

Strong S.W. gales blew over the Bay of Biscay, while in these islands southerly winds were prevalent.

Sept. 27.—A general decrease of pressure occurred at all stations in Great Britain, being less in Ireland, and not traceable at Rochefort, the gradient from which station to Cape Clear was 5·7.

A squally S.W. gale blew at all the southern stations, being strongest at Falmouth about noon, while in Ireland and Scotland the wind was easterly, blowing freshly from S.E. at Aberdeen for some time.

Sept. 28.—The high pressures in Norway began to yield, as a fall of 0·4 occurred at Skudesnaes. In the south there was but little change, and the depression still hung at the entrance of the Channel, the gradient from Rochefort to Brest being 10.

Accordingly a furious S.W. gale raged in France, while with us the winds were from the same quarter but moderate. Barometrical readings continued almost unchanged until about 4 p.m., when it began to blow hard from S.E. at Valencia.

Sept. 29.—The new depression had assumed larger proportions, as a decrease of 0·4 in. occurred at Valencia, making a gradient of 8·5 from Rochefort to Cape Clear. In Scotland readings were low. The extremes were 29·63 at Rochefort, 29·46 at Helder, 29·15 at Nairn, and 28·76 at Valencia.

The S.W. gales still prevailed in the south of Ireland, the Channel, and over France, but in Scotland a tendency to E. appeared in the wind.

Sept. 30.—A brisk rise of the barometer set in along the N.W. coast, while a slight fall appeared in the Channel. The centre of the depression, now partly filled up, lay near Wexford, and the gradient from Rochefort to Roche's Point was 6·9.

The gale still continued from S.W. in the Channel and in France, while at Valencia the wind had veered to N.W., blowing fresh, and at Nairn a N.E. gale set in.

Oct. 1.—An extremely sudden rise, amounting to 0·86 at Greencastle, and exceeding 0·7 in. along the N. and W. coast, is reported. A local depression existed near L'Orient, the gradient to which place from Greencastle was 5·1.

The winds all became easterly, having blown a heavy gale at Nairn and Leith, and also at Holyhead, where it lasted longer than at other stations. At Valencia there was a strong N.E. breeze for a short time about 6 a.m.

No. IX.

1869. March 11.—Pressure was somewhat below its normal value, as an extensive area of depression had existed over central France. Readings were highest on our west coast, and they ranged from 29·79 at Valencia and 29·75 at Nairn to 29·19 at Rochefort.

The winds were north-easterly, moderate to fresh.

March 12.—The barometer had risen rapidly over the Bay of Biscay, as the minimum had moved out to Germany; the gradient from Liverpool to Helder was 4·5. It was accordingly blowing hard from N. at Cape Grisnez, and also on the west coast of France.

In Ireland a decrease of pressure had set in, with light southerly winds, and during the forenoon its rate became much accelerated at Valencia, and the S.E. wind freshened. This disturbance came on rapidly, and at Falmouth the wind increased from E.S.E. at 10 p.m., and commenced to blow a gale at 2 a.m., lasting throughout the next day, with a mean velocity of about 40 miles an hour.

March 13.—A decrease of from 0·3 to 0·4 in. is noticed in the south-west, accompanied by a slight rise in the east. The northern barograms were almost unaffected. The extreme readings were 29·87 at Nairn and 29·24 at Cape Clear. The gradient from Leith to the latter station became 6·6.

The winds were all easterly. The gale had begun at Valencia from E.N.E. at 7 a.m., lasting till noon, with a velocity of 47 miles an hour, and then backing slowly to N.N.E., and continuing as a strong breeze through the afternoon.

In the Channel, as already noticed, the gale was still blowing.

By 2 p.m. a rapid rise in pressure is reported from Valencia.

March 14.—The increase in Ireland had amounted to 0·5 in., and the centre of the depression, with a reading of 29·27, lay near Biarritz. The gradient from Ardrossan to Rochefort was 4·6.

The wind in the Channel and in Ireland had moderated, but the disturbance had extended to Yarmouth, where a hard gale was felt.

March 17.—The depression moved out to the Gulf of Genoa and the gales ceased.

No. X.

1869. May 3.—Pressure was rather high and nearly uniform, the highest being 30·12 at Aberdeen, and the lowest 29·78 at Valencia. The winds were light from S.E., drawing to E. in Scotland, and to S.W. on the west coast of France.

During the day a slight depression advanced eastwards, being chiefly noticeable at Armagh and the English stations, and especially so at Kew, where the minimum was reached at midnight.

May 4.—Readings along the Channel coast showed a considerable decrease, amounting to 0·2 in. An apparently independent depression showed itself at Corunna. The gradient from Aberdeen to Cape Clear was 4·8. At Holyhead an E.N.E. gale was reported; however, neither at Stonyhurst nor at Glasgow was the velocity of 20 miles an hour exceeded.

May 5.—A recovery is noticeable in the south-east, while the southern depression had advanced to the Bay of Biscay, causing fresh easterly winds on the French coast. At our stations the direction was S.E. and the force light, except at Falmouth, where a strong E.S.E. breeze lasted most of the day.

A steady reduction of pressure was in progress in the west, and at Valencia the wind freshened to a velocity exceeding 30 miles an hour for a short time at noon. Its direction was E.S.E.

May 6.—The diminution in readings had exceeded 0·5 in. at most of our stations. The reports varied from 29·66 at Skudesnaes to 29·20 at Cape Clear. The gradients being consequently small the winds were light, drawing to N.E. in the north. At Aberdeen a strong breeze from E. began at 6 p.m. and lasted all night. At Valencia a stiff northerly breeze set in 4 a.m. on the 7th and lasted till the afternoon.

May 7.—An elongated trough of low readings extended in a north-easterly direction, the lowest reported being at Cape Clear. Pressure varied in amount from 29·38 at Rochefort and 29·30 at Nairn to 28·96 at Cape Clear. The gradient from Rochefort to Cape Clear was 4; that from Nairn to Shields 6.

To the north-west of the area of depression the wind was fresh from N.E., blowing strongly in the south of Ireland and at Ardrossan. The barometrical minimum had passed over all our stations by noon, and afterwards pressure began to recover rapidly in the north and west, but a slight fresh fall of the barometer is noticeable at Falmouth, commencing at 8 p.m. and reaching a minimum at 4 a.m.

next morning. This was accompanied by a recurrence of the strong northerly winds at Valencia, which began at 11 p.m. and lasted 14 hours.

May 8.—The original depression had become almost entirely filled up, the only trace of it being the local diminution at Falmouth just referred to. Readings ranged from 29·61 at Nairn to 29·12 at Penzance, and the gradient from Greencastle to the latter station was 7·5.

The northerly gales were still reported in the south of Ireland, and had extended to Holyhead, but not to Stonyhurst. In the Bay of Biscay strong westerly winds were felt.

Next day a rapid rise occurred along the Channel and the gale ceased.

No. XI.

1869. May 24.—A general decrease of pressure occurred, being greatest in the west. A long strip of high readings, about 30·05 in., extended all down the east coast to the continent, and on each side of it the reports showed a diminution to 29·84 at Skudesnaes, and 29·71 at Cape Clear. The gradient from Ardrossan to Cape Clear was 5. The winds in these islands swept round the western depression.

May 25.—A considerable decrease of about 0·3 took place in the Bay of Biscay; the gradient above mentioned was slightly increased. The winds drew towards E. and freshened at most of our stations.

May 26.—The depression in the south became greater, while in the north there was little change. The reading at Brest was 29·36, and the gradient to that station from Aberdeen 5. The easterly winds reached the force of a gale at Cape Clear and Holyhead before noon, blowing also hard at Valencia from N.E. by N. for 6 hours.

May 27.—The barometer rose about 0·15 both in the north and the south, so that the gradients remained unchanged, and the gales continued in precisely the same localities as before, but increased somewhat, freshening also during the day for a short time at Aberdeen.

May 28.—A general rise took place, being greatest in the north; readings ranged from 30·27 at Nairn to 29·61 at L'Orient. The gradient from Greencastle to L'Orient was 7.

The easterly winds increased generally, blowing a strong breeze at Valencia, and freshening considerably at Falmouth and Kew.

May 29.—Pressure increased on the Channel coast and the gale ceased.

Remarks on Class B.

No. VI. was a twofold disturbance, each part being caused by the advance of a depression along our south-west coast to the Bay of Biscay, but apparently not further, while readings remained high in the north and east. The gales were confined to the south coasts of England and Ireland, and they ceased when the barometer began to fall in Norway.

In the Atlas des Mouvements Généraux de l'Atmosphère an area of comparatively low readings is shown as existing permanently off the Spanish coast during the entire period. According as this area expanded or contracted on its eastern side, the gales on our southern coast freshened or died down.

No. VII. was a case of a depression travelling from the westward, skirting our south-west coasts and penetrating to central France, where it disappeared.

The high pressures which advanced from the north steepened the gradients for easterly winds, and ultimately caused heavy gales at our southern stations.

No. VIII. During this period we have first a depression passing in along the Channel to the eastward on the 25th, and dying out when it reached the continent, as it did not affect the readings in Germany.

In its passage easterly gales were felt over the southern and central portions of the United Kingdom. Gradients in the south were steep, so that heavy S.W. gales were reported in the Channel and in France.

The barometer then fell generally over these islands, and a depression passed out to Norway, the easterly winds entirely disappearing, but readings did not recover materially in the west, so that an area of low pressure hung persistently off the south coast of Ireland. Accordingly, when on the 30th the barometer began to rise quickly in the north, a N.E. gale set in at Nairn which swept down the west coast, according as the centre of the depression moved to L'Orient.

No. IX. was a simple instance of a depression travelling along our south-west coasts to France, but it differed from that noticed in No. VII., inasmuch as it advanced as far as the Gulf of Genoa. Northern readings were not affected at all.

No. X. consisted of a series of gales caused by successive oscillations of the barometer. The first depression travelled to the Bay of Biscay. The second was more extensive, and ultimately concentrated itself near Penzance, where it died out.

No. XI. was due to a depression which advanced from the westward to Brest and disappeared there.

The storms in Class B. exhibit this difference as compared with those in Class A., that they generally gave the first sign of their approach by a fall of the barometer in the west of Ireland, which did not extend to the northern stations.

In Nos. VII. and VIII. the N.E. gale was caused by the advance of a wave of high pressure from the Atlantic to the north-western stations.

Class C.—Depressions advancing along the English Channel.

No. XII.

1868. April 7.—On the previous day pressure had been nearly uniform and high, with warm weather and westerly winds, light to moderate in force. A depression had hung over Sweden on the 5th and 6th, producing heavy W. and N.W. gales in Southern Norway. This morning its centre had advanced to Riga.

At our western stations a rapid decrease had occurred, amounting to nearly half an inch at Valencia. This was accompanied by a rise of 0·17 at Aberdeen. Readings ranged from 30·04 at Rochefort to 29·59 at Valencia, giving a gradient of 4·5 between these stations.

The winds in Ireland were fresh S.W., but had begun to draw from N.E. in Scotland, and at Glasgow a stiff breeze from that quarter was felt at 1 p.m., while the wind freshened at Aberdeen.

During the day the barometer continued to fall in the south.

April 8.—The depression had advanced to the Channel, where the fall was about 0·5 in., while a slight recovery had begun in Ireland. The extreme readings were 29·89 at Nairn, and 29·37 at L'Orient. The gradient from Greencastle to Portsmouth was 5·3.

The winds had all become north-easterly, and had even drawn to N.W. at Penzance and Brest. A gale had been reported at Cape Clear and Ardrossan, and was now blowing at Scarborough and Holyhead. At Falmouth the velocity of 30 miles an hour was reached about noon, and the wind remained strong until next morning.

April 9.—A rapid rise is reported, especially in the Channel. The centre of the depression lies over Luxembourg. The gradient from Valencia to Helder is 5.

The N.E. gales had extended along the Channel, blowing very hard at Yarmouth, and then moderating.

No. XIII.

1869. March 18.—On the 17th there had been a sudden fall of the barometer over the Irish Sea, causing stiff N.W. gales in Ireland. This morning, however, we see a very rapid recovery in the south and west. The minimum reading is 29·58 at Nairn, and the highest 30·03 at Brest, giving a gradient of 5·1 between Brest and Greencastle.

The winds were light except at Cape Clear, where a N.W. gale was reported.

During the forenoon the barometer continued to rise in the west, but fell on the east coast and in Norway. A local W.N.W. squall blew at Ardrossan and Glasgow about noon.

March 19.—At 1 a.m. the barometer at Valencia began to fall very rapidly, reaching its lowest point before 8 a.m. At that hour the centre of the depression, with a reading of 29·4, lay near Cork, the gradient from Rochefort to that station being 8·2. The disturbance travelled quickly to the eastward, being less marked in the north than in the south, in fact scarcely traceable in Scotland.

The actual time of registration of the minimum was at Valencia 7.30 a.m., at Armagh 10 a.m., at Falmouth and Stonyhurst 2 p.m., and at Kew 8 p.m. The barograms show a much more abrupt depression at Falmouth than at Stonyhurst. At Valencia the subsequent recovery of pressure was very rapid.

The wind at Valencia had backed to S.S.E. at midnight, and increased to a gale at 2 a.m. As soon as the barometer began to rise at 8 a.m. the wind suddenly veered to N.W., and blew hard from that point for three hours, continuing as a stiff breeze till the evening. At Falmouth the wind backed also, but only to S.W., beginning to blow a gale at 7 a.m. The veer to N.W. was more gradual than at Valencia, and took place about 2 p.m., at which hour it was noticed at Pembroke also. The velocity at Falmouth was extremely high, averaging 59 miles an hour from 11 a.m. to midnight, amounting to 72 miles between 4 and 5 p.m., and the storm lasted in all for 61 hours, veering slowly to N., but abating materially on the last day. At Holyhead an E.N.E. gale was felt during the night, and at Kew a strong northerly breeze was registered for four hours from midnight. At Stonyhurst there was only a moderate N.E. wind, and there was no disturbance in Scotland.

March 20.—The rapid decrease had extended eastwards, and the area of least readings lay near Brussels, where the report was 29·32, while it was 30·16 at Valencia. The gradient from the latter station to Cape Grisnez was accordingly 9·1.

The polar gale had extended to France, where, as well as along the south coast of England, it was blowing hard from N. and N.N.E.

Next day the depression over Belgium disappeared, and the gales died down.

No. XIV.

1869. Nov. 28.—An oval area of depression lay over Belgium at 8 a.m., while a rapid increase was in progress in the west. The gradient from Valencia to Wick was 7, from Rochefort to Paris 12.

Temperature was high over France, Brest being 22° warmer than Aberdeen.

The wind was generally north-westerly, light to strong, with a W. gale in France, as well as at Falmouth and Holyhead. At the former station it had blown hard from W.S.W. all through the 27th, and lulled at noon on this day; at the latter the gale began from W.N.W. at 6 a.m., and lasted for 18 hours. There was a strong N.W. breeze during the day at Aberdeen, and a considerable increase of velocity at Glasgow, but not elsewhere.

Nov. 29.—A rapid rise occurred, especially over Belgium; however, a fresh depression had approached our western coasts during the night, causing a "back" of the wind to S.E. and S. At

Valencia the wind freshened from S.E. at 9 a.m., but soon veered to W.; the velocity of 30 miles an hour was registered for six hours.

The depression travelled to the south-eastward with extreme quickness, but was scarcely noticed in the north.

At Falmouth the wind backed to S., but the gale began from W. at 2 p.m., soon veering to N., blowing harder than at Valencia, and lasting 42 hours.

At Holyhead the back to S.E. took place, but the gale set in from N. at 10 p.m., and lasted 37 hours, with much greater velocity than at Falmouth or Valencia.

Nov. 30.—The centre of the depression lay over Luxembourg, the diminution of pressure affecting Spanish readings also. The gradient from Valencia to Brussels became 6.

The northerly gales were still reported on the west coast of Great Britain, with westerly gales in the Bay of Biscay. N. and N.E. winds were prevalent over these islands, and at 8 a.m. there was a stiff breeze from N. for a short time at Yarmouth, extending to Scarborough by 2 p.m., but not to any of the observatories.

Dec. 1.—A general rise of the barometer varying from 0·3 to 0·5 in. occurred, the gradient from Valencia to Cape Grisnez remaining unchanged. As, however, the increase had been greater in the west than in the east of France, the wind over that country veered to N., blowing hard. The northerly gale still raged along St. George's Channel.

Dec. 2.—A considerable decrease appeared in the west, making gradients much less, and causing the northerly gales to cease and the wind in the west of Ireland to back to S. and S.E.

The weather over Great Britain was very cold, Valencia being 28° warmer than Leith.

By 2 p.m. there was scarcely any change, except that the wind had drawn to N. at Valencia.

Dec. 3.—The barometer rose to some extent in the west and north, while the area of depression had advanced to the coast of Brittany.

The winds backed to E. in the south of England, and at 9 a.m. a slight gale began at Falmouth from E., lasting only 4 hours; at Yarmouth from N. veering to E., and lasting with little intermission for 37 hours; at Scarborough the gale began at 2 p.m., and at 9 p.m. at Holyhead.

The most rapid rise of the barometer during the day was 0·8 at Greencastle.

Dec. 4.—A remarkable decrease occurred in the south-east, being chiefly marked at Kew, and scarcely traceable elsewhere except at Stonyhurst. This change, taken in conjunction with the rise in the north-west, made the gradient from Nairn to Cape Grisnez 7.

The gale at Holyhead was heavy, and lasted till 6 p.m. At Falmouth a northerly gale began at 9 a.m., veered slowly to E., and lasted for four days, but without attaining very great violence. On the east coast the easterly gale lasted until the evening.

No. XV.

1870. March 2.—After the passage of a barometrical depression out to the north-east, readings rose to the extent of 0·6 in. in the north of Scotland, and pressure ranged from 29·83 at Paris to 29·43 both at Wick and Cape Clear, and 29·04 at Christiansund. The gradient from Greencastle to Pembroke was 4·5. However, a decrease had occurred at the south-western stations during the night, and a fresh disturbance was apparently advancing to the Channel.

In France the winds were fresh from south, but a fresh N.N.E. breeze began at Valencia at 9 a.m., lasting with an average velocity exceeding 30 miles for 50 hours. It freshened considerably at midnight. At Holyhead it began at 2 p.m. from N.N.E., increased towards midnight, veering to N.E., and blew hard in the forenoon of the next day.

March 3.—A depression amounting to 0·2 in. appears in the Falmouth barogram, but is not noticeable at any other observatory. Pressure has increased briskly in the north, and readings vary from 29·96 at Nairn to 29·28 at Penzance. The gradient from Leith to the latter station is 9.

The N.E. gale had increased on the south coast of Ireland and at Holyhead, while the wind freshened during the day at Armagh and on the east coast of England, a gale being reported at Scarborough at 2 p.m., and at Yarmouth at midnight.

March 4.—The barometer had risen rapidly everywhere except at the south-eastern stations. The extremes recorded were 30·34 at Thurso, and 29·57 at L'Orient. The gradient from Scarborough to Cape Grisnez was 8.

The easterly gale accordingly continued at Holyhead and Yarmouth through the day, freshening also at Kew and Glasgow, but moderating in Ireland.

March 5.—Pressure continued to rise and the gale abated, lasting, however, till evening at Yarmouth.

Remarks on Class C.

No. XII. was a simple case of a depression advancing along the south coast of Ireland and the Channel to Germany, where it disappeared. The gales were felt only in the southern and central parts of England and Ireland.

No. XIII. was a storm beginning at S.S.E. in the west of Ireland, and then shifting very suddenly to N.W. as soon as the barometer had reached its lowest point, and ultimately blowing from N.E. at Holyhead and from N. in the Channel. The disturbance travelled with very great velocity along the parallel of 51° from Valencia to Holland.

No. XIV. shows us two depressions, one following on the other in quick succession. The first travelled along the Channel to Holland, the second advanced over the north coast of France, on a parallel track.

Both gave rise to heavy N. and N.E. gales.

No. XV.—A depression of slight extent advanced along the Channel, while the barometer rose briskly in the north. The N.E. gale began first in Ireland, and subsequently extended to the east coast of England.

Class C. resembles its predecessor in respect of the storms showing themselves first in the south-west of Ireland. The direction of their advance is, however, nearly due easterly. This particular storm track is not an uncommon one, but the disturbance is not always accompanied by easterly gales.

It will be seen that these storms were scarcely felt north of Holyhead.

Class D.—Depressions advancing from the N.W. across England to Holland.

No. XVI.

1867. Jan. 6.—A very sudden change of weather had occurred after a period of intense cold. A S.E. gale set in on this day, and temperature in the neighbourhood of London rose 19° within the 24 hours. The thaw was so rapid in some parts that the moisture was observed to be condensed on the *outside* of windows during the greater part of the day. The gale lasted in the Channel on the 7th. This disturbance had advanced steadily from the Atlantic, as traced in Capt. Toynbee's "Report on the Use of Isobaric Curves," pp. 10–12.

Jan. 8.—Barometrical readings all over these islands were below 29 inches, the absolute minimum, 28·50, being somewhere near Belfast. There was apparently a general deficiency of pressure over Europe, as the highest reported was 30·2 in. This was the reading both at Naples and St. Petersburg. The gradient from Rochefort to Weymouth, however, continued very steep, amounting to 10, so that heavy westerly gales were blowing along our south coast. Winds were light in the north, drawing towards E. Temperature was 18° higher at Weymouth than at Nairn.

Jan. 9.—The depression had advanced to Norway, the lowest reading being registered at Skudesnaes at 8 a.m., while the barogram at Kew showed a marked and rapid recovery, which had amounted to 0·4 in. at the stations in Scotland and along the east coast of England. The reports from the south of Ireland and St. George's Channel show that a fresh depression had advanced to nearly the same district as that of the previous day. The gradient from Rochefort to Holyhead was 13·3, the reading at Rochefort being 29·53, that at Holyhead 28·60.

The wind also gave evidence that a great change had taken place in pressure, for while W.N.W.$_{10}$ had been reported at Yarmouth and N.$_8$ at Aberdeen, the direction had backed to S.S.W. on the east coast of England, and veered to N.E. and N. in Scotland, while heavy westerly gales were still blowing in the Channel.

Jan. 10.—A very rapid rise occurred in Ireland, while in Scotland the change was less. The centre of depression had now advanced to Yarmouth, where the reading was 28·88, while at Rochefort it was still 29·53. The gradient from Leith to Yarmouth for a N.E. wind was 8.

The winds had all veered to N. and N.W., and moderated, except on the coast of Yorkshire, where a gale from N. and N.E. was felt. Similar weather continued in this district for some days.

No. XVII.

1869. June 13.—A general decrease of pressure had occurred, which was greatest in the south, where it amounted to 0·4 in. Readings were remarkably uniform, ranging from 29·73 at Rochefort to 29·46 at Leith.

The wind in general was light, but a northerly current was appearing in the north-west, causing a fall in temperature, while weather was very warm along the east coast of England.

June 14.—The depression had advanced eastwards, and its centre lay near London, where the reading was 29·40. The gradient for northerly winds was steep over the south of England, being 8 between Roche's Point and London.

The wind drew to N., blowing freshly at Falmouth, and causing temperature to fall rapidly in the eastern counties.

In the evening the wind increased from W.S.W. at Valencia, and lasted all night at that point. A fresh depression came on, the dip being just noticeable at Valencia at 10 p.m., but not perceptible at Aberdeen. The disturbance advanced very irregularly, passing Armagh at midnight, Glasgow and Falmouth both at 4 a.m. At Stonyhurst the mercury remained steady at the minimum reading for six hours, from 4 to 10 a.m. At Kew the hollow was registered at 10 a.m.

June 15.—A recovery is noticed which is rapid in France, but less so in Holland. The area of depression lies over the north of England, with the minimum reading 29·40 at Shields and Leith, the highest being 30·09 at Rochefort. The gradient between these stations was 5.

The wind freshened to a westerly gale at Holyhead and L'Orient, blowing also a strong breeze from W.N.W. all day till 6 p.m. at Falmouth.

At Aberdeen a fresh easterly wind was felt in the morning, and at Glasgow the velocity of 40 miles an hour was registered from 9 a.m. till noon. At noon the wind increased also at Stonyhurst.

During the day a rapid rise of the barometer was noticed, except in the south and east.

June 16.—A remarkable recovery of pressure occurred in the north and west, and extended to Scarborough, where the rise was 0·5 in., while at Yarmouth the mercury was steady, and at Helder there was a fall of 0·3. The gradient from Penzance to Yarmouth was 9.

Heavy N.W. gales had been felt at several western stations, and a very severe storm from N. and N.E. off the coast of Yorkshire and the north of England. During the day the increase of pressure extended to Yarmouth, where the gale began from N. at noon.

No. XVIII.

1869. Aug. 28.—The weather had been unusually hot for a few days, when on the 27th pressure rose rather quickly in the north, producing a general N.E. wind.

This morning readings were remarkably uniform, ranging between 30 in. and 30·25; however, a decrease exceeding 0·25 in. had appeared in the north, where the wind remained light but drew to W.N.W.

This depression travelled southwards, scarcely affecting the Irish stations; the hollow passed Glasgow at 6 p.m., Stonyhurst at midnight, and Kew at 6 a.m. By 2 p.m. the recovery had commenced at Nairn, and almost immediately a cold north wind began to flow over Scotland, finding its way along the meridional valleys, like that of the Caledonian Canal, some hours previous to its being felt in the transverse glens.

The actual time of commencement of this northerly gale is given by Mr. Buchan in a note on the sudden change of temperature in the last week of August 1869 (Journal of the Scottish Meteorological Society, vol. ii. p. 322), as

3.30 at East Linton.
4 „ Edinburgh.
6 „ Carnwath.
7 at Callander.
8–9 at Arrochar.

To this statement I would only add that it began in the Sound of Jura about 4 p.m.

The change of temperature produced by this cold northerly wind was most extraordinary, as recorded in Mr. Buchan's paper, the fall amounting to 35° at Marchmont, Dunse within the space of from five to seven hours.

There is one very remarkable peculiarity about this gale, which is, that although it blew hard locally, all the observatories escaped it on this evening, the highest velocity recorded before midnight being 24 miles an hour at Glasgow about 9 p.m.

At Holyhead it began to blow a gale at 3 a.m. from N.W. veering to N.

Aug. 29.—By this morning the centre of the depression had reached the S.E. of England, while a stiff gale from N. was reported to have been felt in the North Channel, at Greencastle and Ardrossan. The gradient from Leith to Helder was 6. The highest reading was 30·35 at Nairn, the lowest 29·91 at Helder.

The winds veered to N., blowing a gale at Holyhead and Valencia. At the former station the velocity of 50 miles an hour was reached at noon.

At 3.30 p.m. the barometer had begun to rise at Yarmouth, and a heavy N.N.W. gale began, while the wind freshened from N.E. at Kew. About midnight a strong easterly breeze was felt at Falmouth and Plymouth, lasting till the morning.

Aug. 30.—The rapid increase had ceased in the north but had extended to the south-east, so that gradients became less and the gales ceased.

No. XIX.

1869. Oct. 15.—A barometrical depression was situated over the Gulf of Bothnia, having advanced from the westward, while a sudden decrease had appeared at all our stations, amounting to 0·5 in. at

Greencastle. Readings varied from 30·26 at Biarritz to 29·56 at Nairn, and the gradient from Rochefort to Leith was 5.

The winds were westerly at most stations, and in force moderate to fresh. Temperature was low in the extreme north, Wick being 17° colder than Ardrossan.

The fall of the barometer continued during the day, especially at Nairn.

A strong S.W. breeze began at Holyhead at noon, and at Valencia at 6 p.m., lasting through the night, and freshening to a gale for two hours after midnight at the former station. At Falmouth a similar breeze was noticed for a short time after 1 a.m. At the northern stations, however, the gale was E.N.E., beginning at Sandwick at 1 a.m., increasing to 40 miles an hour at 2 p.m., and lasting with a velocity of 43 miles an hour for 19 hours.

At Aberdeen the wind suddenly veered to E. at 6 a.m. (16th), and at once began to blow very heavily, the velocity at 10 a.m. being 60 miles an hour, and the average hourly velocity from 6 a.m. for 10 hours being 53 miles.

This wind backed to N., and lasted as a fresh breeze until noon on the 17th.

Oct. 16.—The depression had advanced southwards, the fall being greatest in the south-west and least at Wick. The centre of depression lay near Dundee. Readings ranged from 30·05 at Biarritz to 29·12 at Aberdeen, giving gradients of 5·5 from Biarritz to Leith, and of 12 from Wick to Aberdeen.

The N.E. gales were still blowing in the north, and continued at Sandwick through the whole day, the maximum velocity, 55 miles an hour, being recorded at 2 a.m. on the 17th.

In Ireland the wind was N.W., and at Holyhead a westerly gale was felt in the morning, which shifted to N. by 3 p.m., and blew very hard from that point for 22 hours, averaging 50 miles per hour. The highest velocity was 73 miles from N. between 6 and 7 p.m.

At Falmouth also a fresh westerly breeze began at noon, and lasted 24 hours, veering to N.W. The westerly gale reached Yarmouth at midnight.

Oct. 17.—The disturbance had moved across to Norway, the hollow passing Christiansund at 2 p.m A very rapid rise had followed it in these islands, the reading being 30·05 at Valencia, while it was 28·76 at Skudesnaes. The gradient across the North Sea from Greencastle to Skudesnaes was accordingly 12, while that from London to Helder was 11.

A very sudden depression of temperature is noticed at all our stations, especially those on the south-east coast.

The N.E. gales had been heavy in the north, but the wind had now backed to N.W., and was blowing very hard on the east coast. During the ensuing night another depression advanced to the north-western stations, while the wind at Holyhead backed to S.W. again, and blew hard at midnight.

The minimum readings on the 18th were registered respectively at—

Glasgow and Aberdeen - - - - -	at 6 a.m.
Armagh and Valencia - - - - -	Noon.
Stonyhurst - - - - - -	2 p.m.
Falmouth - - - - - -	4 p.m.
Kew - - - - - - -	Midnight.

The rise of pressure in Norway does not exhibit any check throughout the period.

Oct. 18.—The isobars show the new depression in nearly the same position as that of its predecessor of the 16th, the lowest reading being 29·32 at Ardrossan, and the highest 29·94 at Rochefort. The gradient from Rochefort to Holyhead was 6·5.

The northerly winds were strong at Valencia during the day, and at Falmouth a fresh westerly breeze was felt up to noon. At Holyhead the wind after a temporary lull veered again to N. and blew a strong gale, 53 miles an hour, for 27 hours from 8 p.m.

During the day the barometer fell quickly in the south, but rose smartly in the north of these islands and in Norway. Strong northerly winds were felt at Aberdeen and Glasgow during the afternoon, and at midnight a stiff N. breeze set in both at Sandwick and Falmouth, and lasted till the afternoon of the next day.

Oct. 19.—The centre of the depression (reading 29·14) was now at Yarmouth, while a rapid rise had set in both in the north-west and in Norway, making the gradient from Greencastle to Yarmouth 12.

Heavy N. to N.E. gales swept over England, being felt more or less at all the English observatories, but exerting their greatest force at Holyhead. The wind increased at Yarmouth at noon, but only to the velocity of 30 miles an hour.

Pressure soon rose generally and the gales died down.

REMARKS ON CLASS D.

No. XVI. was not a well-marked easterly gale. The first depression advanced to the north-eastwards, and the only strong northerly winds connected with it were felt at Aberdeen. The barometer then rose very rapidly over Scotland, and accordingly there were steep northern gradients when the second depression made its appearance. This latter travelled from W.N.W. across the centre of England, and caused local easterly gales.

No. XVII. was a very local northerly storm. A depression advanced from the N.W. over England, and was followed by an extremely rapid recovery of pressure. The centre of disturbance moved down along the east coast to Yarmouth, and the gale was only felt seriously on that coast.

No. XVIII. was also a local gale. The depression advanced from N.N.W. across Great Britain to Belgium.

No. XIX. was a double gale, being caused by two distinct disturbances. The first hung for two days in Scotland, and then crossed over to Norway. The second travelled down the east coast of Great Britain, moving from N.W. nearly at right angles to the path of its predecessor. Both these depressions, especially the second, gave rise to easterly gales.

The indications of these storms were mainly given by the behaviour of the barometers in the north of Scotland; the direction of the wind was more generally northerly than easterly.

CLASS E.—DEPRESSIONS ADVANCING FROM N. OR N.N.E.

No. XX.

1867. Nov. 29.—After a period of very high barometrical readings over these islands, with light winds and a prevalence of fog in the Channel, accompanied, however, by strong westerly winds in Norway, where a rapid rise was in progress, pressure began to give way in Ireland, where the wind had veered to S. and was fresh. The temperature at Cape Clear was 20° warmer than at Rochefort.

The barometer was uniformly high over France and Spain, while in Russia it was low.

Nov. 30.—The diminution of pressure became general, but most rapid at Valencia. Readings ranged from 30·22 at Helder to 29·54 at Valencia. The gradient from Helder to Roche's Point was 6·5, while that from Penzance to the same station was as much as 11.

The area of high pressure had receded to central Europe, while the depression had begun to affect Norway.

The southerly wind had extended to all our stations, and was blowing very hard at Penzance and in the south of Ireland, while a severe S.W. gale had set in at Christiansund also.

The mercury continued to fall at all stations during the day.

Dec. 1.—The fall of the barometer had exceeded an inch at Skudesnaes, and was also very serious at all our stations. The centre of the depression appears to lie near the Shetlands, as the reading of 28·99 was reported from Nairn. The highest readings reported are from Austria and Italy, where the weather was very cold with easterly winds.

The gradient from Rochefort to Penzance was now 10, the area of depression was very elongated in shape, its longer axis lying nearly in the direction from S.W. to N.E., from Cork to near Skudesnaes, and a rapid recovery had commenced in the west of Ireland.

Heavy S.W. gales were blowing in the Channel, while along the north-western edge of the disturbance N. and N.E. winds had begun, blowing a gale at Valencia. In Scotland it was nearly calm.

Dec. 2.—A most rapid rise of the barometer, exceeding an inch at some stations, had occurred in the west. The centre of the depression had now advanced to Skudesnaes, where the reading was 28·69, while at Valencia it was 30·16.

The gradient from Valencia to Helder was 10, while that from Nairn to Skudesnaes was 16·5! The high pressures over Italy began to yield.

Northerly gales of extreme violence had set in at several stations, the direction being N.E. at Shields, Ardrossan, and in the south of Ireland.

The fall of temperature exceeded 20° all along the east coast of England.

During the day the rate of increase of pressure slackened, but uniformly so, over these islands, and accordingly the wind did not moderate except in the north. This local abatement of force was due to the fact that up to 2 p.m. the rise at Skudesnaes was 0·4, while at Nairn it was 0·1.

Dec. 3.—The rapid recovery still went on at our stations, and at Skudesnaes it amounted to 1·25 in. The gradients were much reduced, that from Valencia to Helder becoming 6; that from Liverpool to Helder was 8, while that from Nairn to Skudesnaes was now only 5.

The wind had moderated in the west and drawn to E. in the south of Ireland, but along the east coast of England, where the gradients for northerly winds were steep, the storm was still raging.

In the afternoon a slight fall of the barometer appeared at Valencia and Nairn, and at the former station the wind veered to S.S.E., remaining light.

Dec. 4.—A fresh decrease in pressure, exceeding 0·2 in., set in along our N.W. coast, the lowest readings 30·00 being in the north, while the area of maximum reports was in the Channel, Plymouth reporting 30·47. This change in the distribution of pressure was caused by the advance of a barometrical minimum southwards over Norway. The hours at which the lowest readings were respectively noticed, as given in the Aarbog, were—

Dec. 4.		Dec. 5.		Dec. 6.	
Tromsö	2 p.m.	Dovre	8 a.m.	Sandosund	8 a.m.
Vardö	8 p.m.	Skudesnaes	2 p.m.		
Bodö		Bergen	8 p.m.		
Christiansund		Mandal			
Aalesund		Christiania			

The winds in the west were fresh from S.W.; in the east the gales had moderated.

During the day the barometer began to fall everywhere.

Dec. 5.—Under the influence of the depression just noticed all the readings along our east coast fell briskly, about 0·3; however, the minimum report in these islands (29·70) was still at Nairn, while the reading at Valencia was half an inch higher.

The wind was generally north-westerly, but moderate in the west.

During the forenoon a recovery began at Nairn, and the wind at Valencia increased from N.N.W.

Dec. 6.—Another rapid increase came on in Scotland, while the area of depression had advanced southwards, and now hung over Rhenish Prussia. The reading at Helder was 29·63, while at Valencia it was 30·29, so that the gradient between these stations again became 6. Heavy N. and N.N.E. gales recommenced in the west, and at Shields the wind drew to E.N.E., freshening to a gale at Scarborough by 2 p.m.

Dec. 7.—The increase of pressure continued, especially over central England, while in Holland it was rather less, and the gradient from Liverpool to Helder was 8. The area of depression had travelled down to Italy.

The wind had moderated over the Irish Sea, but hard N.E. gales were felt all down the east coast of England, from Scarborough to Portsmouth.

No. XXI.

1869. March 27.—A barometrical depression had been advancing southwards over Norway for two days past, the minimum reading being registered as follows:—

March 26.		March 27.
2 p.m.	8 p.m.	8 a.m.
Bodö.	Skudesnaes.	Mandal.
Christiansund.	Sandosund.	
Aalesund.	Christiania.	
Dovre.		

On this day a general decrease in pressure since the preceding morning was noticed, attaining its greatest extent 0·47 at Helder. The isobars ran nearly due north and south, and readings varied from 30·08 at Valencia to 29·30 at Skudesnaes.

The gradient from Nairn to Skudesnaes was 7·5, and that from Valencia to Helder 5·5.

Temperature had fallen smartly, as much as 10° on our east coast.

The wind was northerly, fresh to strong, and squally. At Sandwick a northerly gale had blown all day long on the 26th, moderating by noon on the 27th, on which day, at about 9 a.m., a strong breeze from the same point set in at Aberdeen, Glasgow, and Stonyhurst, lasting, however, only a few hours. The Irish stations did not feel this increased velocity of the wind, but at Falmouth it commenced at 1 p.m. and lasted till night.

March 28.—A recovery of pressure had commenced in the north, amounting to 0·5 in. at Skudesnaes. The centre of the depression lay near Dover. There was no great general disturbance of pressure, as readings only ranged from 29·98 at Greencastle to 29·46 at London. The gradient between these stations was accordingly 7, but that from Leith to Scarborough was 11.

The wind had moderated at most stations, but a heavy N.E. gale was reported from Scarborough, and all down the west coast of England and Wales the northerly storm had recommenced, lasting all day at Falmouth.

In Great Britain the wind veered towards E. during the day, blowing hard at Aberdeen and Glasgow, and for a short time at Kew. It then backed to N. and recommenced to blow a slight gale at the last-named station at 4 a.m. on the 29th; about the same hour a severe N.E. gale set in at Yarmouth and on the Kentish coast.

Note.—This was the gale in which H.M.S. "Ferret" was driven ashore at Dover.

March 29th.—The wave of high pressure had advanced southwards, while the area of depression had assumed an elongated shape over central France. Readings ranged from 30·22 at Nairn to 29·53 at Cape Grisnez. The gradient from Ardrossan to the latter station was 8, while that from Yarmouth to the same point was 13.

The N.E. gale continued along the south and south-east coast, with heavy hail and a high sea.

March 30.—The depression apparently died out as the barometer on our south-east coast rose about 0·2 in., and the gradient from Ardrossan to Cape Grisnez was reduced to 5.

No. XXII.

1869. Oct. 25.—Pressure was high and fairly uniform, ranging from 30·45 at Valencia to 30·00 at Wick, and winds were north-westerly. However, a rapid decrease was in progress which reached a maximum at the Scotch stations in the evening, and at those in the south of England at 4 a.m. next morning.

At Sandwick a gale began from W. at 9. a.m., veering to N.N.W. by 5 p.m., and continuing at that point for three days, with a mean velocity of 43 miles an hour.

At Aberdeen and Holyhead northerly gales began at 8 p.m.; at the former station the wind did not much exceed a strong breeze, and lasted for 24 hours. At Holyhead the violence increased very rapidly, and the gale blew heavily for 3½ days.

At Falmouth a N.N.W. gale set in at 4. a.m. 26th, and lasted 12 hours, averaging 44 miles an hour about noon for three hours.

Oct. 26.—The rapid decrease had been succeeded by a rise in the north-west, and the greatest fall was reported at Skudesnaes.

The total difference in readings was 1·16 in., from 30·33 at Valencia to 29·17 at Skudesnaes; accordingly gradients across the North Sea were steep, 8·3 from Valencia to Skudesnaes.

Heavy N. and N.W. gales were blowing on the N. and W. coasts of Great Britain, but were not felt in Ireland at all. The force was very great at Holyhead, and even at Stonyhurst the velocity almost attained 30 miles an hour at noon.

At Yarmouth it also freshened temporarily to a strong N.W. breeze in the afternoon.

These conditions continued until next morning, when at 4 a.m. the gale again came on at Falmouth from N. for 12 hours, as on previous day.

Oct. 27.—Pressure fell uniformly about 0·1 in., and the absolute minimum, 29·08, was registered at Skudesnaes at 8 a.m. The gradients were unchanged, so the gale held in precisely the same districts and with the same violence as on the previous day, freshening considerably about midday at Glasgow, Stonyhurst, and Yarmouth for some hours.

At Falmouth, at 4 a.m., 28th, the wind again increased, but to a less extent than on the two preceding days, only reaching the force of a strong breeze, and lasted till the afternoon.

Oct. 28.—The rapid rise of the barometer extended to Norway, throwing the area of lowest readings to Denmark. Pressure varied from 30·21 at Valencia to 29·45 at Helder, giving a gradient of 6·6 between these stations.

The winds accordingly veered to N., still blowing hard in St. George's Channel. At midnight the wind at Yarmouth veered to N. and then to N.N.E., blowing very hard.

Oct. 29.—A general recovery of pressure took place, which was greatest in the east, and the gales died down.

No. XXIII.

1869. Dec. 21.—A rapid decrease of about 0·5 in. occurred over the west of France, with an increase of equal amount in Norway. Readings thus became uniform, but were rather lower in the south and on the Channel coast than in Ireland. The winds were light from N.

During the day the barometer continued rising along our western coasts.

Dec. 22.—The region of high pressures advanced from the N.W., and the lowest reading, 29·29, was at Toulon. Over these islands the reports varied from 29·94 at Valencia to 29·46 at Cape Grisnez, giving a gradient of 6·6 from Greencastle to London.

The northerly winds freshened at the western stations, and had already begun to blow a strong gale at Holyhead at midnight, increasing to 60 miles an hour at noon, and lasting with considerable force for three days. At Falmouth and Valencia the northerly wind reached the velocity of 30 miles an hour at 4 p.m., and at Yarmouth the gale began at the same hour and lasted all night.

Dec. 23.—By this evening the gradient from Valencia to Cape Grisnez had increased to 7·5, while the gale held at Yarmouth and Holyhead from N.N.E. At these stations the storm continued all day, while at the southern observatories the winds were fresh from N.

Dec. 24.—The barometer rose, especially in the south-east, so the gale died down gradually, ceasing at Holyhead at 4 p.m. and at Yarmouth at 8 p.m.

Dec. 25.—Readings became more uniform as the reports from the north showed the approach of a fresh disturbance, which travelled nearly due southwards.

The hollow passed Aberdeen about midnight,
Glasgow at 2 a.m. (26th),
Stonyhurst and Armagh at 6 a.m.

At Valencia the oscillation was scarcely traceable, and at Kew it was much flattened out. At Falmouth, however, it was very abrupt and irregular, the absolute minimum passing about noon This depression in its passage caused strong N.E. and E. gales.

At Sandwick the gale began at 6 p.m. and lasted nine hours. At Aberdeen it began at 11 p.m. from N., veering to E., blowing very hard from 2–4 a.m. (26th) and lasting all day on the 26th, but with much less force. At Glasgow the N. gale began at 1 a.m. and blew for four hours, lasting fresh all day.

At Holyhead the gale began from N. at 8 p.m., veering to N.N.E., and lasting 32 hours. This storm was very local, for while at Holyhead the average velocity from midnight to noon next day was 62·5 miles an hour, it was 17 at Stonyhurst and 12 at Armagh, the direction in each case being the same as at Holyhead.

Dec. 26.—A considerable depression is noticed over England, with its centre at Yarmouth. The gradient from Greencastle to Pembroke was 10.

The gales freshened at Holyhead and at Shields and then died down, blowing, however, rather hard at Yarmouth on the 27th.

Remarks on Class E.

No. XX. was a northerly gale of great violence, comprising two distinct disturbances. The first advanced eastwards to Norway, while the second travelled nearly due southwards from the North

Cape to Italy. In both cases there were steep gradients on the northern side, and consequently heavy N. and N.E. gales.

No. XXI. was a depression advancing from Bodö in a direction nearly S.S.W. to Holland, and causing severe polar gales, especially about Yarmouth and Dover.

No. XXII. was a case of a depression travelling from Norway down the east side of the North Sea. Heavy northerly gales were felt, which, however, did not affect Ireland at all, and the wind veered to N.E. according as the barometer rose over Norway.

No. XXIII., like No. XX., was a twofold disturbance. The first depression moved across France to the Mediterranean, while the second travelled nearly due south over the British Islands. Both of them caused severe northerly gales, veering to N.E.

Of these storms Nos. XX. and XXI. gave certain indications of their approach in the Norwegian telegraphic reports. This class of disturbance is, therefore, comparatively easy to foresee, now that direct communications have been established between this country and Norway.

CLASS F.—SPECIAL CASES.

No. XXIV.

1864. Oct. 17.—On the 16th there had been a general decrease in pressure, which was very rapid in the North and had brought on fresh S.W. winds on our west coasts, amounting to a gale over the Irish Sea. This morning the disturbance had moved out to the North Sea, where there was a rapid fall at Heligoland. The highest reported readings were those in Italy. Over our area the range was from 29·92 at Rochefort to 29·20 at Nairn, giving a gradient of 5·1 between those stations.

The winds in these islands were moderate to fresh, and in direction from S.W. to W., veering to N.W. in Ireland. Over Europe generally variable winds prevailed. During the night the absolute minimum of pressure passed Skudesnaes, but without causing a serious storm.

Oct 18.—The area of depression lay over Norway. In these islands there was little to remark, except that readings rose in the north and fell in the south, reducing the gradient of the preceding day to 3·6. Winds over Europe were westerly, but in the west of Ireland they began to back.

Oct 19.—A sudden serious fall had set in at all the south-western stations, reaching a maximum of 0·60 in. at Penzance. This was accompanied by a rise over the North Sea. The centre of the fresh depression lay off the entrance of the Channel, where the reading was about 29 inches, while at Heligoland it was 29·68, and the gradient from Yarmouth to Pembroke became 8·2. Strong southerly gales are reported on the Cornish coast, while freshening north-easterly winds have appeared in Ireland.

Temperature is 11° higher at Penzance than at Valencia.

Oct. 20.—The depression has disappeared from the south-west, and has *apparently** moved in a nearly due N.N.E. direction, as the fall at Leith has been 0·81 and the rise in the south 0·2. The centre of the depression lies near Aberdeen, with a reading of 28·64, while at Rochefort the mercury stands at 29·57 in. The gradient between these two stations is accordingly 7.

This disturbance advanced very rapidly, passing Skudesnaes at 2 p.m. and Christiansund at 8 p.m., but was unaccompanied by much wind at either of those stations.

In these islands the wind, having blown a stiff southerly gale in the Channel and at Holyhead, while a very severe easterly storm had swept over the north of Scotland, had moderated generally, but had backed to N.N.W. at Nairn, where it continued to blow hard.

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* This is a simple surmise, there is no evidence to show either the connexion or the distinction between the two depressions. The self-recording observatories were not in existence in 1864. The single barogram from Kew Observatory is insufficient to decide the point.

During the day a strong westerly gale was felt at most stations. Temperature fell in the South.

Oct. 21.—A sudden increase of nearly an inch is reported in Scotland, while a fresh depression is advancing to the Channel, its centre being nearly in the same position as that of the 19th. Readings ranged from 29·60 along the east coast of Great Britain to 29·16 at Valencia, and the gradient from Ardrossan to Valencia was 8.

The wind near the centre of the depression was very strong, and heavy gales were felt, their direction being N.E. in the south of Ireland and S.E. at the entrance of the Channel. The westerly gales of the previous day had now reached Norway.

Temperature was much higher in the south than in the north of England, and even Yarmouth was 14° warmer than Shields.

Oct. 22.—The reduction of pressure had become general, and extended to all but the extreme northern stations. It was greatest about Penzance, where the lowest reading 28·77 in. was observed, while at Nairn it was 29·66, giving a gradient of 10 for easterly winds between the stations. The easterly gales had extended to the Irish and Scotch stations, and it was blowing hard from that quarter at Aberdeen at 8 a.m., while in the south of Ireland the wind had moderated. It was still blowing very hard from south at the southern stations.

Oct. 23.—The centre of the depression has advanced to Liverpool, but the amount of rarefaction is decreasing. The extreme readings are 29·53 at Rochefort and 28·95 at Liverpool, while the gradient for easterly winds from Nairn to the latter station is 10.

A rapid rise of the mercury is in progress in the south, with a depression of temperature.

Severe easterly gales are still reported from Scotland, accompanied by high westerly winds along our southern coasts. The direction of the wind in Ireland was still N.E., but its force light.

This depression ultimately advanced to Norway, but was much less marked in that country than with us. It chiefly affected the barometrical readings at the southern stations. The only gales felt were from N.E. at Mandal.

Two days subsequently, on the 25th, another slight disturbance advanced to Brittany, where it disappeared, after causing local E.S.E. gales in the Channel. A permanence of easterly winds then ensued.

Remarks.—These gales were due to the passage of a succession of depressions, of which the first *apparently* advanced very quickly up the Irish Channel and across to Norway. The second travelled much more slowly along the same track, with very steep gradients along its northern side, and nearly died out before it crossed the North Sea. The third was very slight in amount and scarcely moved beyond Brest.

No. XXV.

1868. July 22.—Pressure was remarkably uniform and rather high, nearly 30 in. at all stations, a slight decrease having occurred in the south and west.

Winds were light and weather warm. A slight westerly gale had just passed over the north of Norway.

In the afternoon an increase of 0·1 in. was noticed at Nairn.

July 23.—A brisk rise of 0·46 at Nairn, diminishing gradually in a southern direction until we reach Helder, where there was a slight fall, produced a moderate gradient of 4·5 from Greencastle to Helder.

The winds drew to N. and N.N.W. over the district where the barometer had risen.

During the day the increase went on very rapidly in the east of England, while at Rochefort the mercury fell slightly.

July 24.—The barometer continued to rise, but to a much greater extent at the eastern stations than elsewhere. At Rochefort there was no change of importance, and the gradient from London to that station became 6.

The wind in the Channel veered to N.N.E., and in the Bay of Biscay to N.E., blowing hard at Cape Grisnez, Weymouth, and Brest, but only being registered at Falmouth as a strong breeze. It extended to Penzance by 2 p.m.

July 25.—A slight diminution of pressure occurred over these islands, and the gales died down.

Remarks.—This gale was very slight, but was interesting, owing to the fact that it was caused by the advance of a wave of high pressure from the N.W., while readings remained steady in France.

GENERAL REMARKS.

The number of these storms is quite insufficient to allow of any important generalizations as to their origin being drawn.

It will be seen that in the majority of instances all conclusions as to the probable character of the storm must be drawn in great measure from the reports from our own coasts. If it were possible to receive reports from a series of stations, ranged along a meridional line, north and south of Valencia, it might perhaps be possible to foresee, from the relative rise or fall of the several barometers, the changes which were taking place in the gradients, and so to form an opinion as to the chance of easterly winds gaining force on any part of the coast. Unfortunately, however, the reporting stations are very irregularly distributed round our shores. The north-west coasts of Ireland and Scotland—the very districts from which we ought to derive the earliest intimation of the increase of gradients for easterly winds—are those whence we can hardly hope to obtain any information at all.

The area of high pressure, which makes these gradients steeper over our islands, and ultimately causes the storm, very frequently advances on us from the north-west; the signs of its approach are given by the observations in the north of Scotland, or at Greencastle; but only a few hours before the storm itself breaks out.

We have then to fall back on the simple, practical rule for classes A. B. and C.

> If the reports from the extreme southern or south-western stations show a considerable reduction of pressure, and at the same time the wind at the more northern stations shows a tendency to draw beyond S.E. to E. and N.E., there is reason to fear an easterly gale.

The problem is more complicated in the case of classes D. and E. when the barometrical depression makes its appearance in the north, for then the barometrical minimum in its passage southwards is almost immediately followed by the easterly gale. In these instances, unless we receive reports from Norway, the telegraphic reports give but little grounds for drawing conclusions of practical value until the storm has burst on the extreme north coast of Scotland.

It is only in four instances out of the entire number, Nos. I., V., XX., and XXI., that clear indications of the approach of the gale could, as far as our present knowledge goes, be recognised in the reports received from eastern stations, such as those in Norway and Russia.

The attempts which have been made hitherto to deduce laws for the thermometrical changes preceding and during storms have not as yet led to results of material service for the issue of telegraphic weather warnings. In the case of the N.W. or N. winds, which come at the end of storms of the ordinary type, the sudden chill which is so well known, is simultaneous with the first gust of northwestwind. Accordingly the thermometrical indications, at least from our stations, come too late to be of use. In Norway important conclusions as to probable weather are being drawn from a comparison of the readings at elevated stations such as Dovre, at a height of about 2,100 feet, with those taken at the sea level. When equatorial gales are approaching the coast it is frequently found that the thermometer at Dovre begins to rise, while the weather at the lower station is still very cold.

As all the telegraphic reporting stations in these islands are close to the sea level, it is evident that we cannot obtain from them any information as to the temperature, &c., prevailing at a height of even 1,000 feet above the sea, so that we cannot hope to carry out similar investigations to those which Professor Mohn is so ably prosecuting in Norway.

The storms which have been described afford direct evidence of the dependence of the direction and force of the gale on the barometrical gradient, while the absolute height of the barometer at any single station has nothing to do with either element.

Thus in No. XI., between the 26th and 27th of May 1869, the barometer rose uniformly about 0·15 in., and the gale was unchanged in direction, force, or locality. The same statement is true of No. XIV. when a rapid general rise took place between Nov. 30 and Dec. 1, 1869.

The converse conditions of a general fall of the barometer, while the gale continued to blow, are presented by No. XXII., between the 26th and 27th of October 1869.

The proportion between the amount of the gradient and the force of the wind is not as yet precisely determined. It will be found that most of the gales were accompanied by local gradients exceeding six hundredths of an inch per 50 geographical miles.—Introduction, p. ix.

Lastly, one remarkable fact which has been brought out by the examination of the automatic observatory records deserves notice. This is the occasional recurrence of a gale at the same hour and and for the same length of time on successive days.

No. III., on the 28th and 29th of April 1869, an easterly wind freshened considerably at Falmouth at the same hour, about 10 p.m.

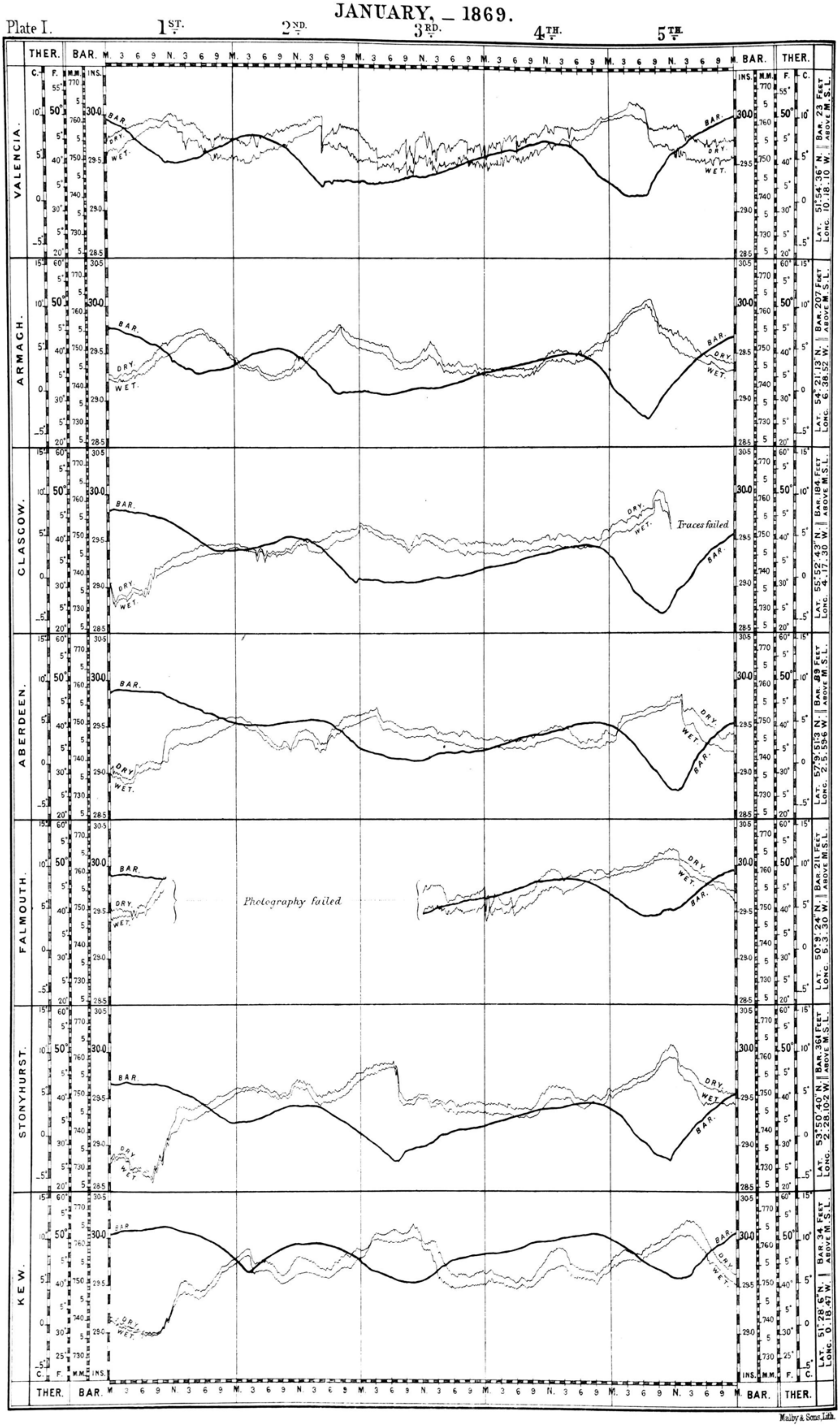
No. XXII. also at Falmouth on the 27th, 28th, and 29th of October 1869, a northerly gale set in at 4 a.m. on each day and lasted till noon.

In the case of other gales an intermittent character similar to the above has not unfrequently been noticed. The fact is curious and well worthy of future investigation.

In conclusion the hope may be expressed that although the immediate results derivable from these "notes" are few in number, the facts here collected and classified may not be without value to future investigators of British storms.

Plate I.

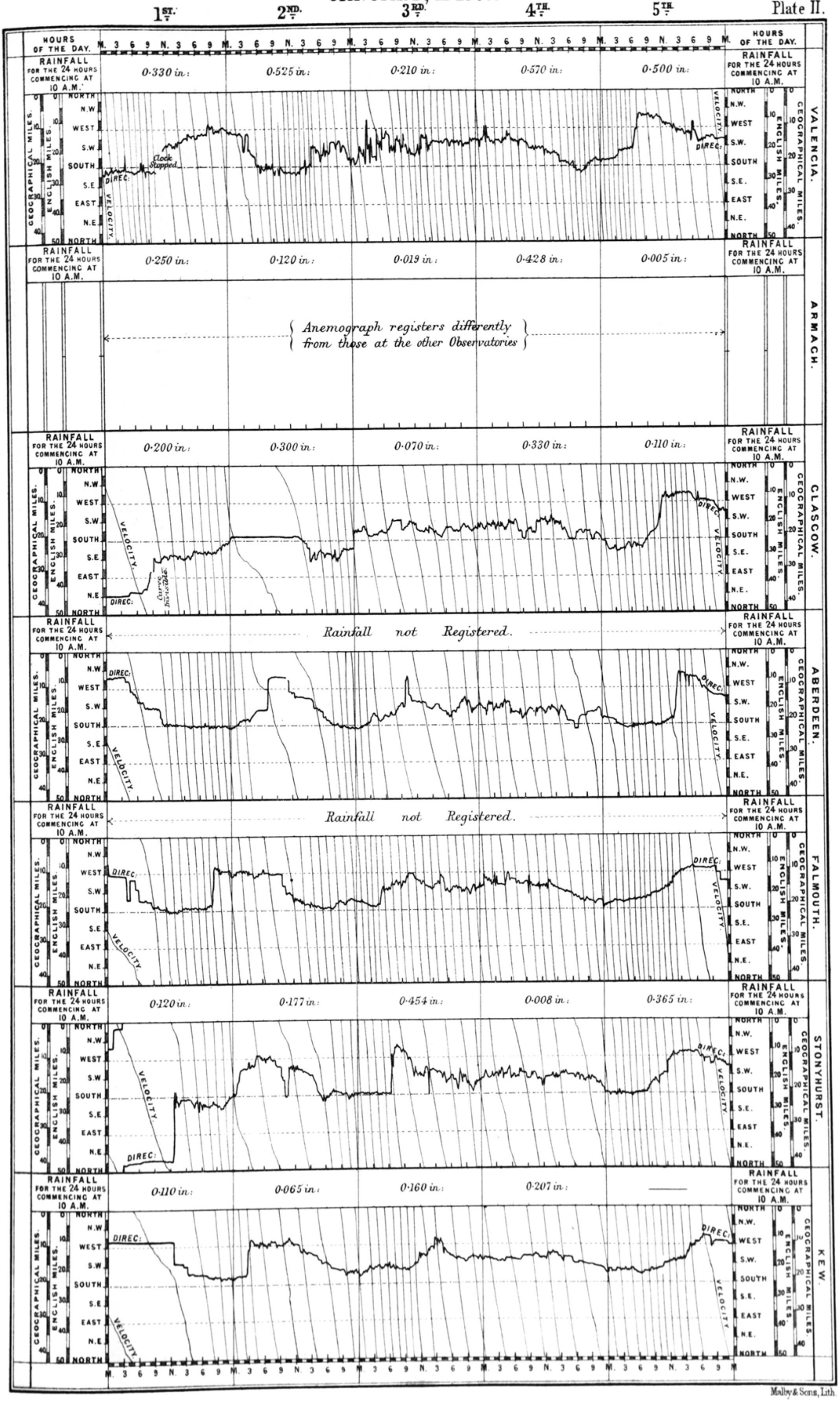
JANUARY, – 1869.



Malby & Sons, Lith.

JANUARY, — 1869.

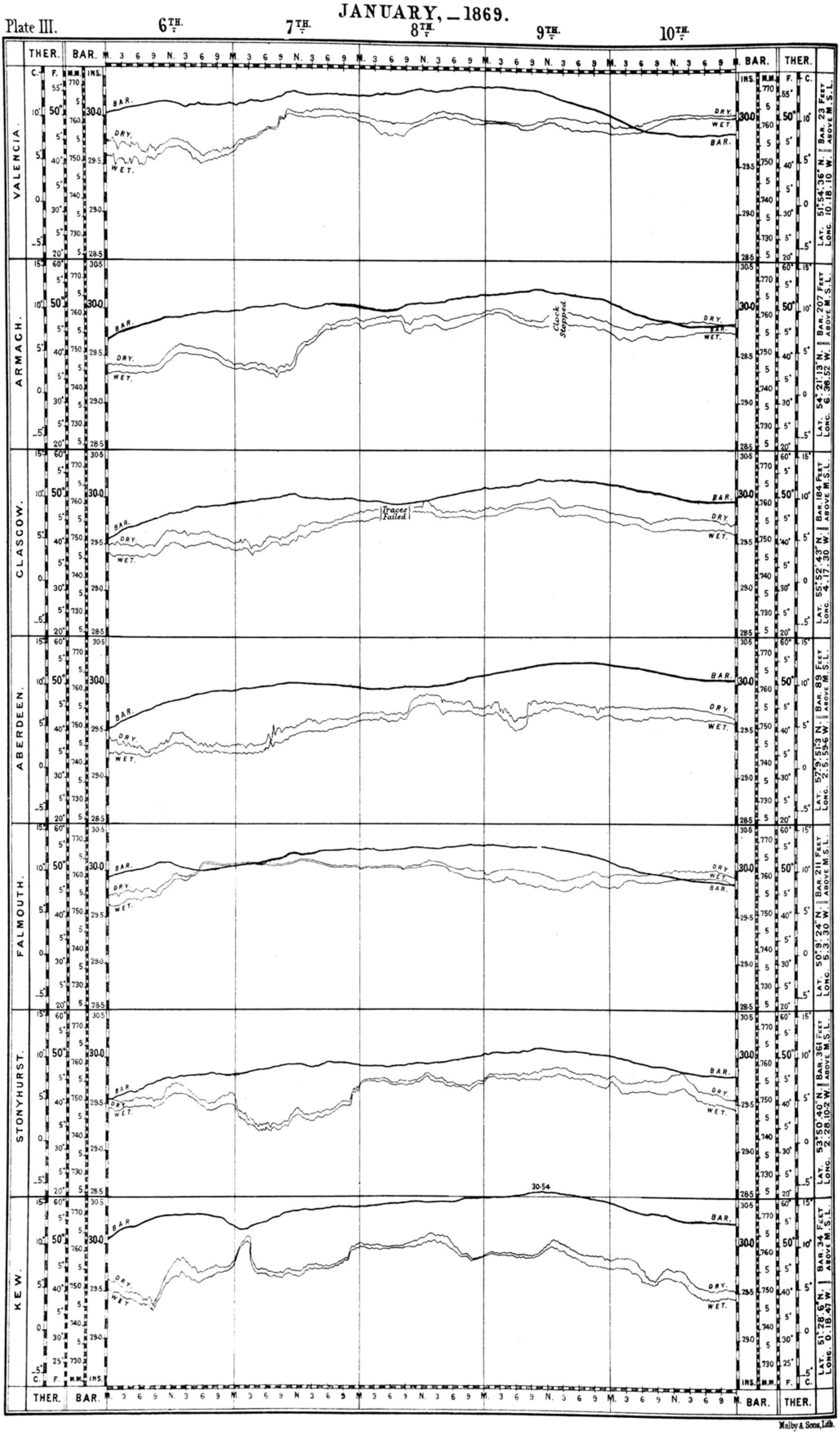
Plate II.



Malby & Sons, Lith.

Plate III.

JANUARY, —1869.



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JANUARY, — 1869.

Plate IV.

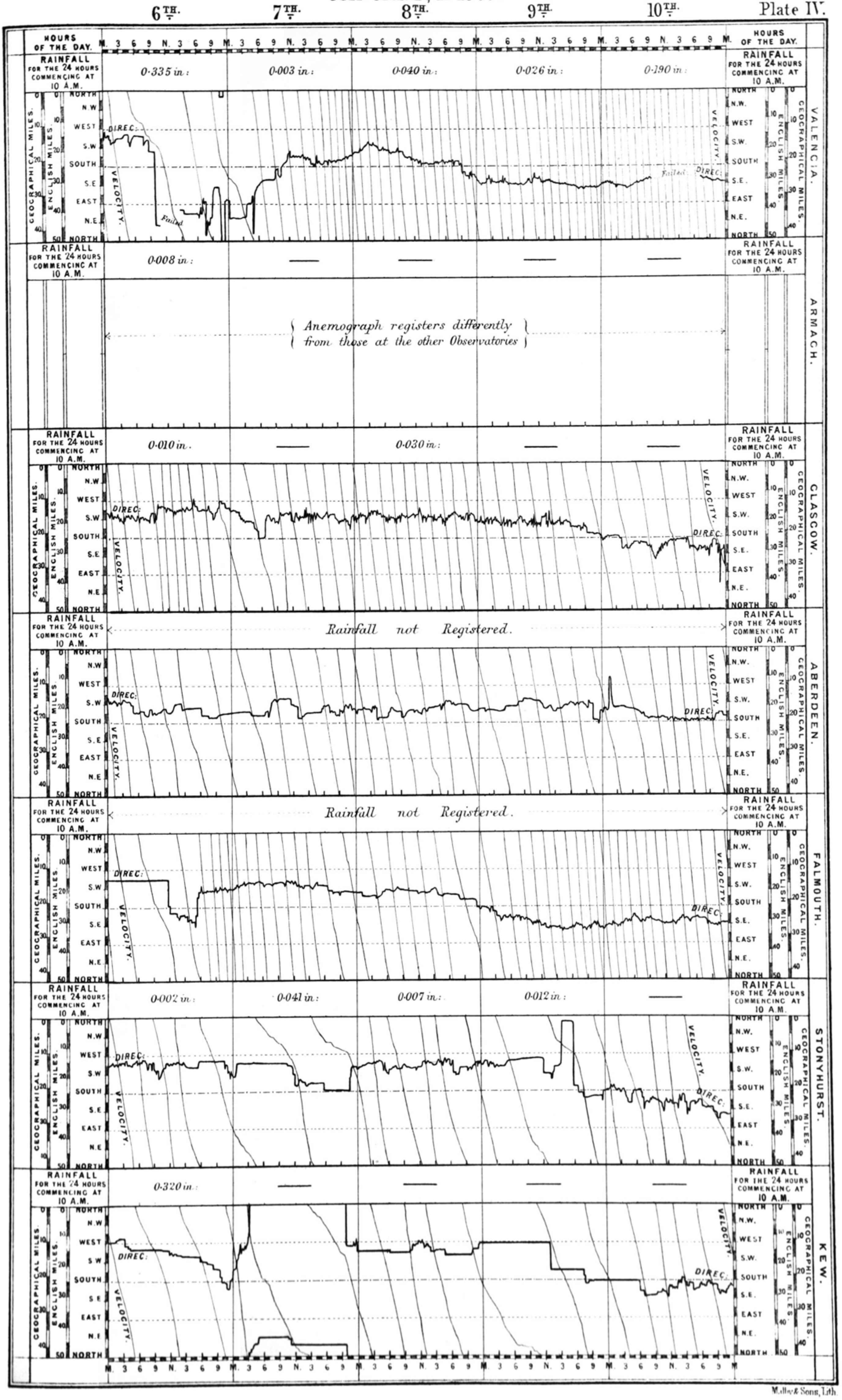

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Plate V.

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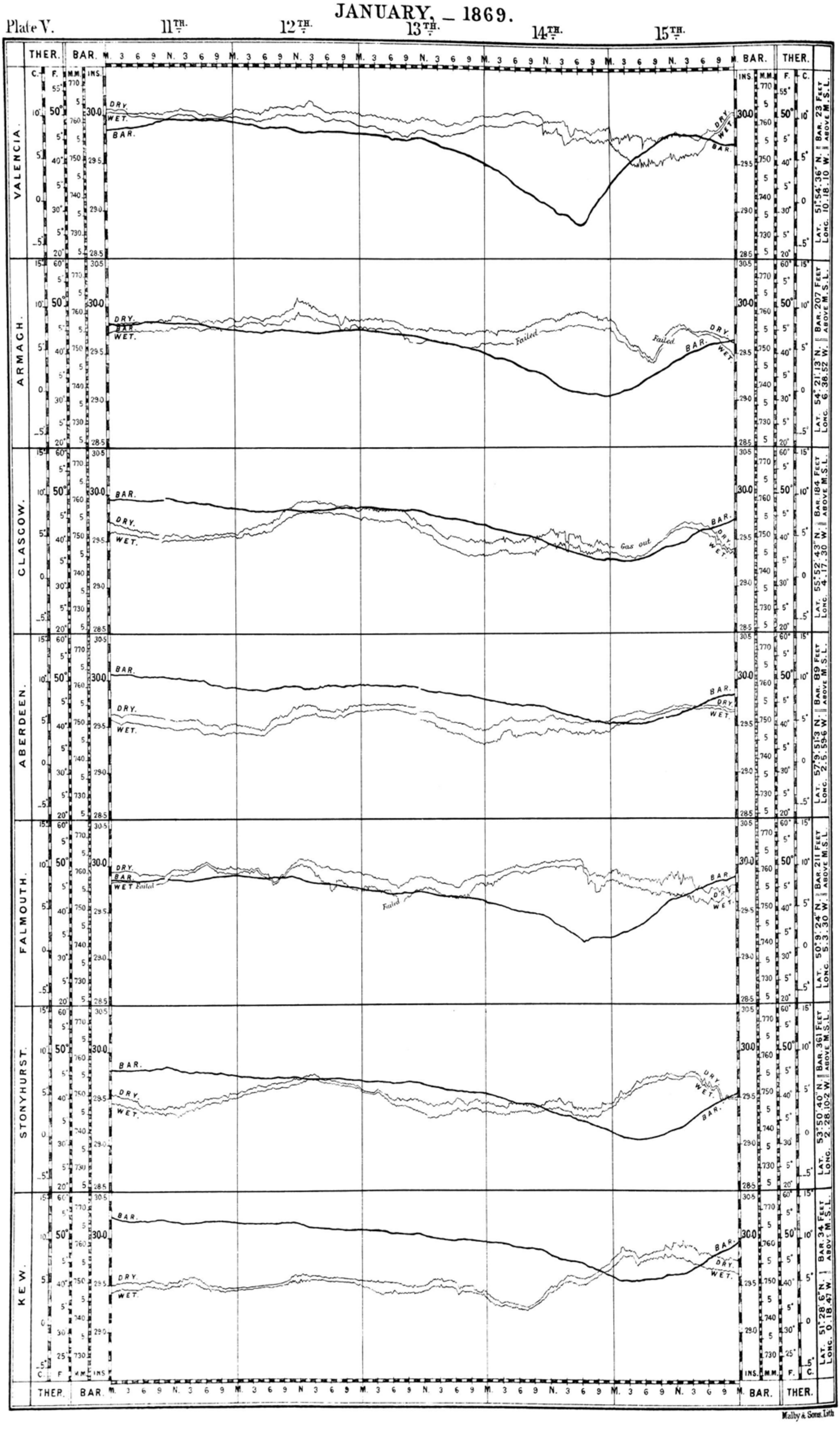

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JANUARY, — 1869.

Plate VI.

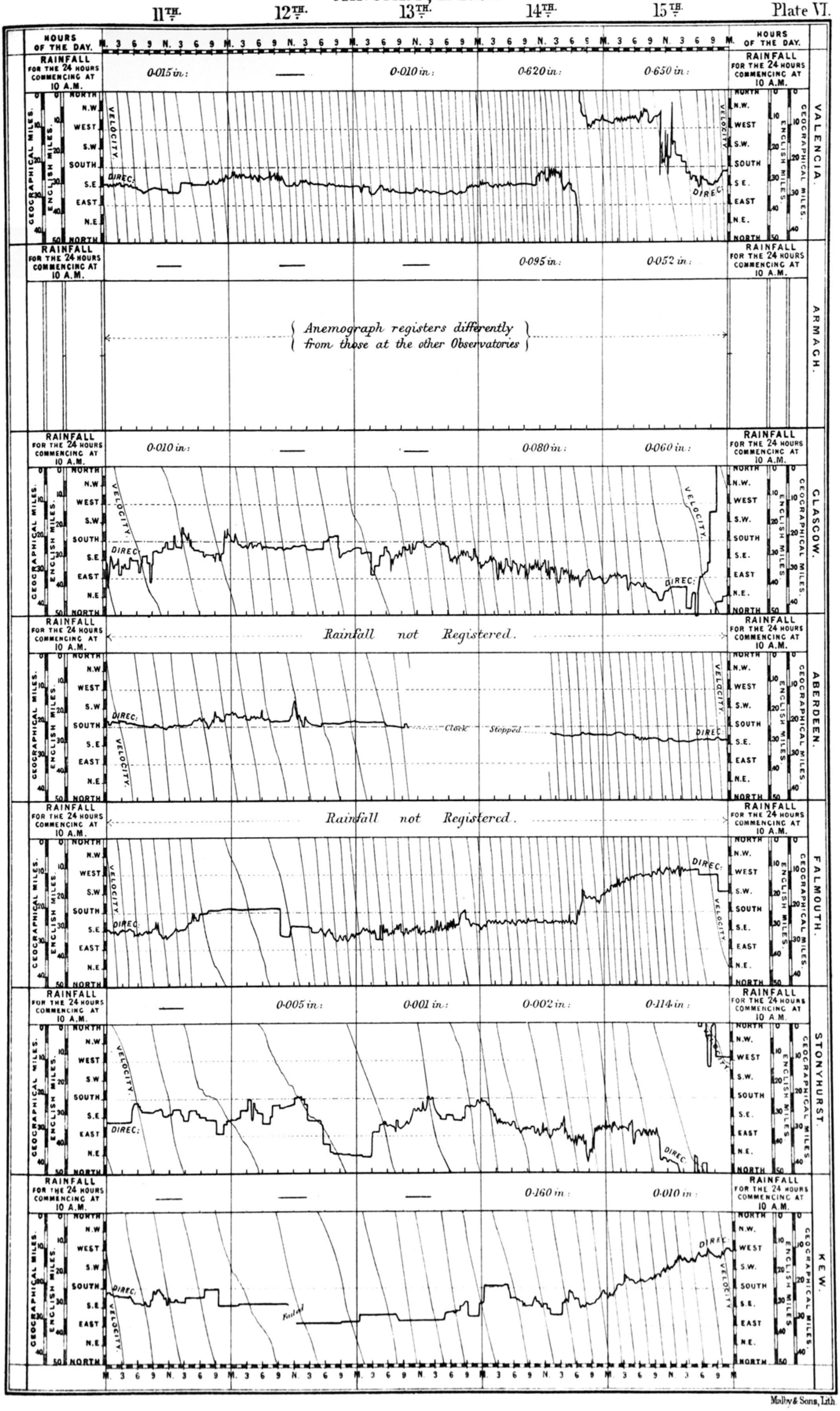

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Plate VII.

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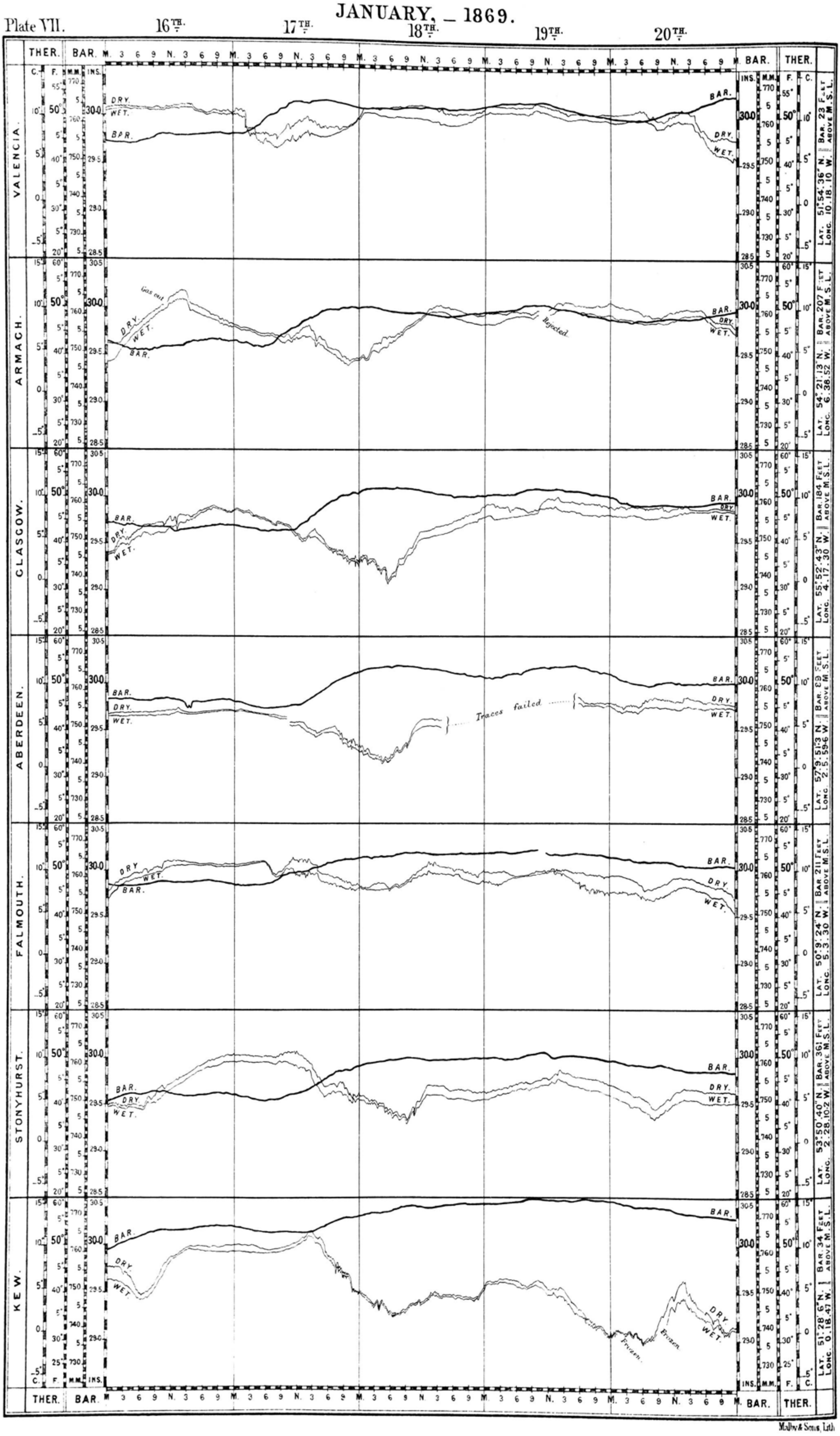

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JANUARY, — 1869.

Plate VIII.

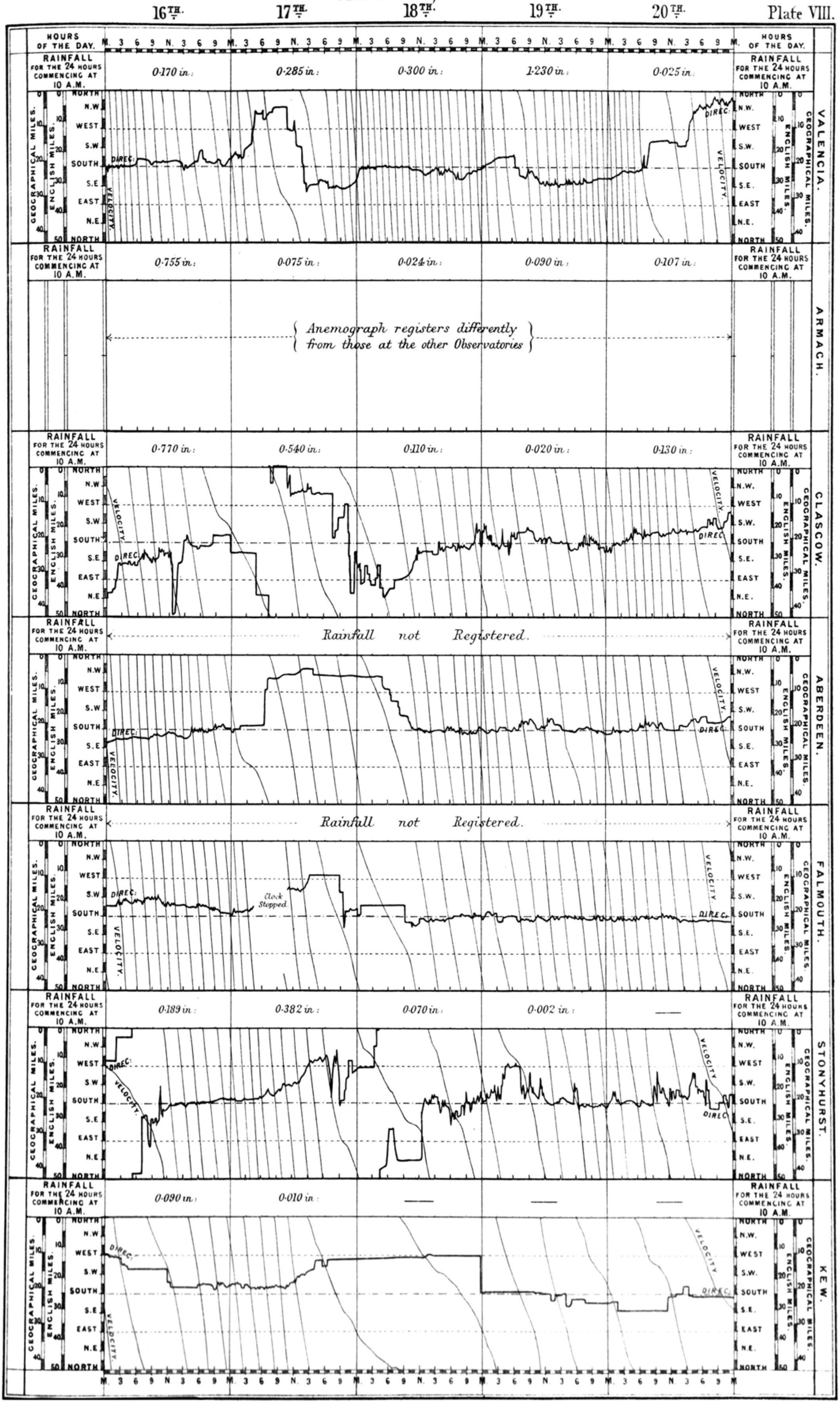

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Plate IX.

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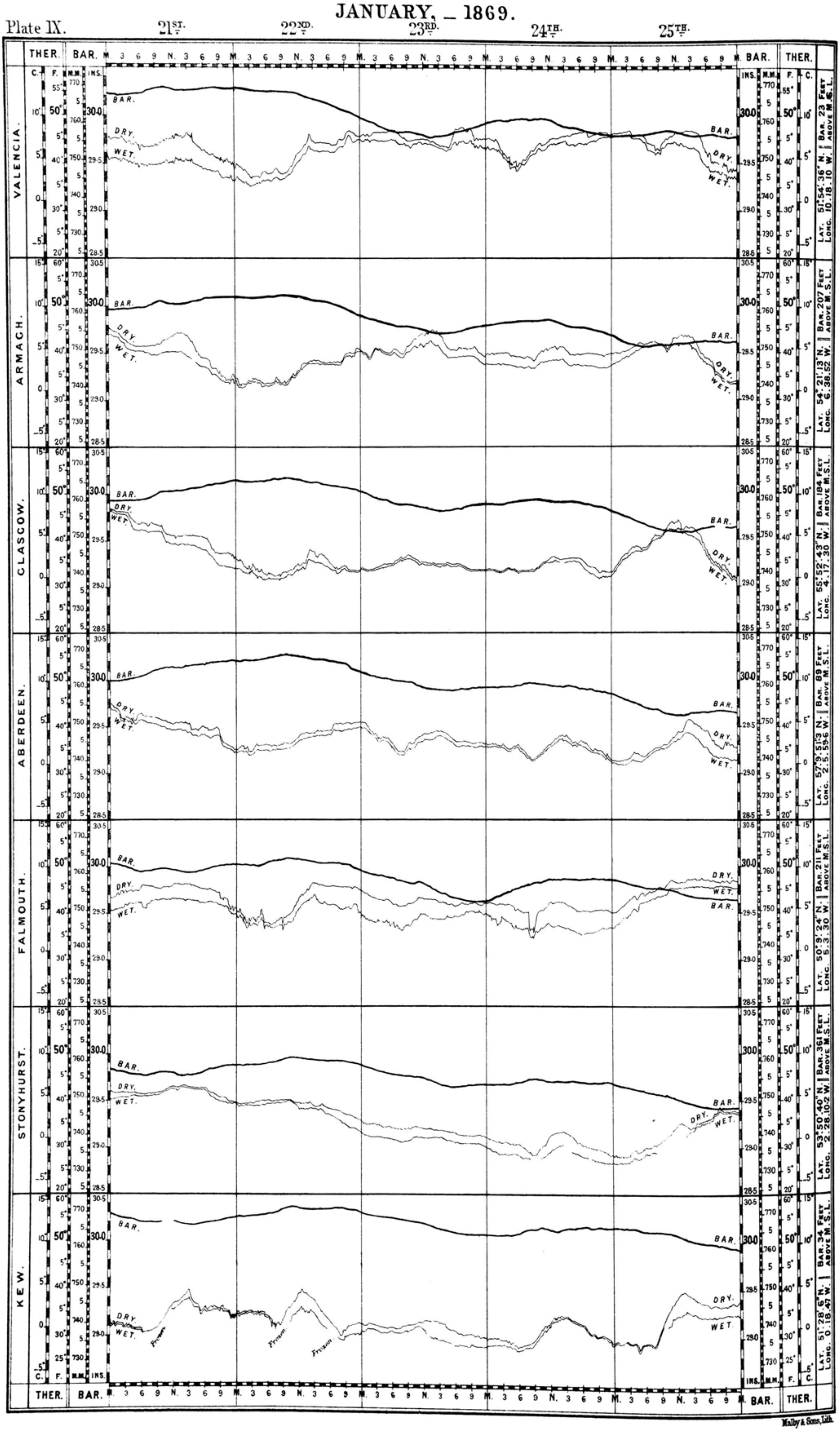

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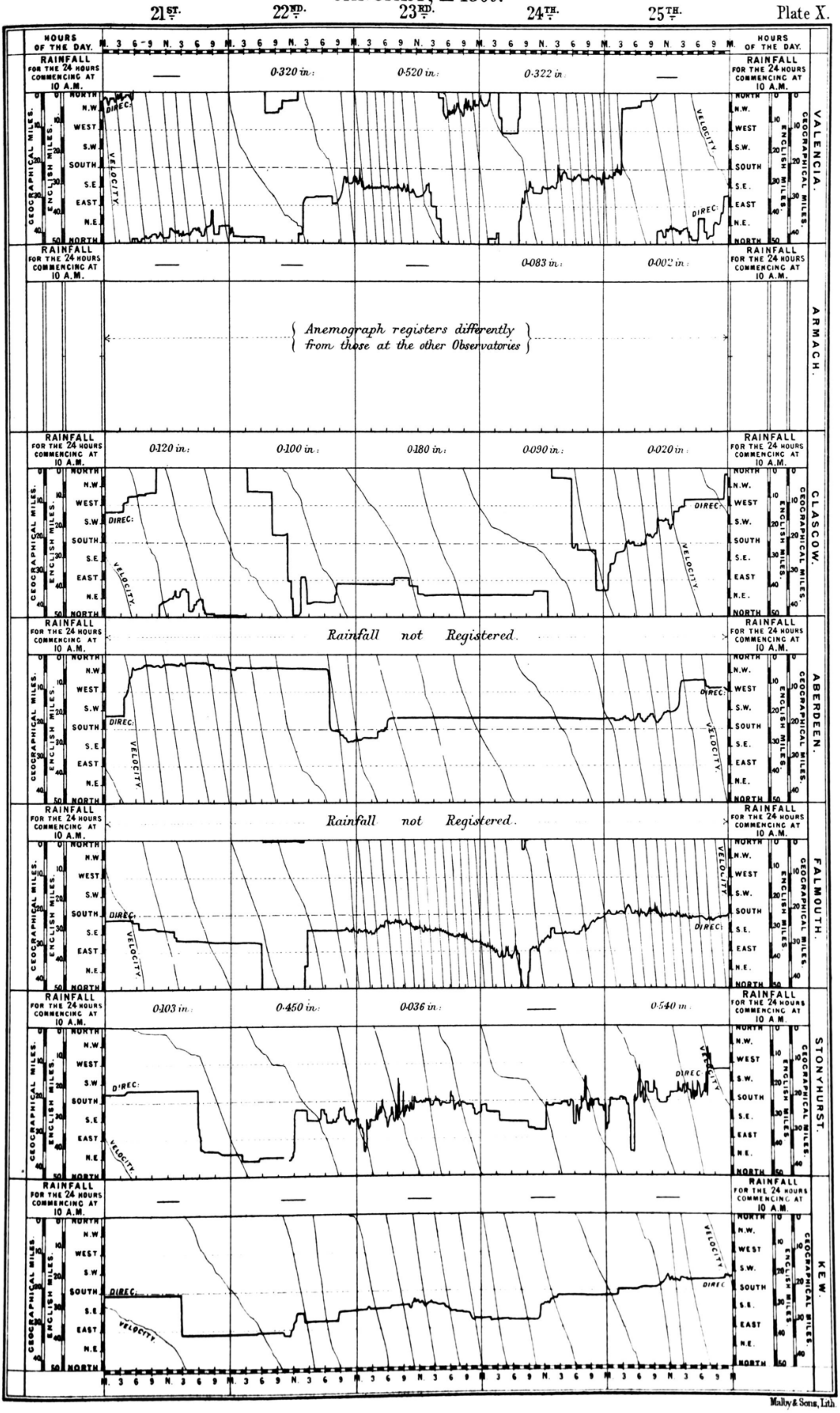

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Plate XI.

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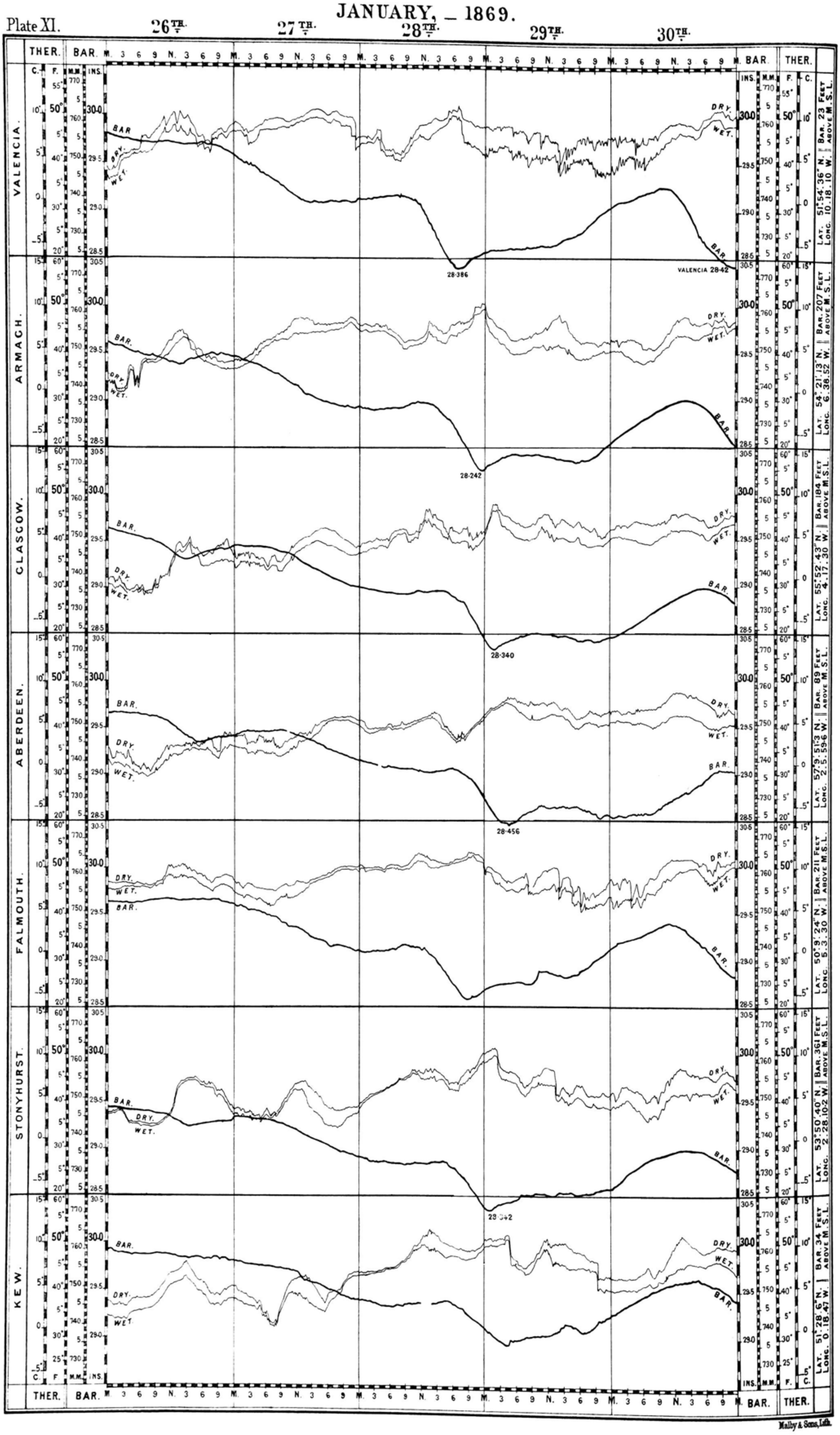

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JANUARY, — 1869.

Plate XII.

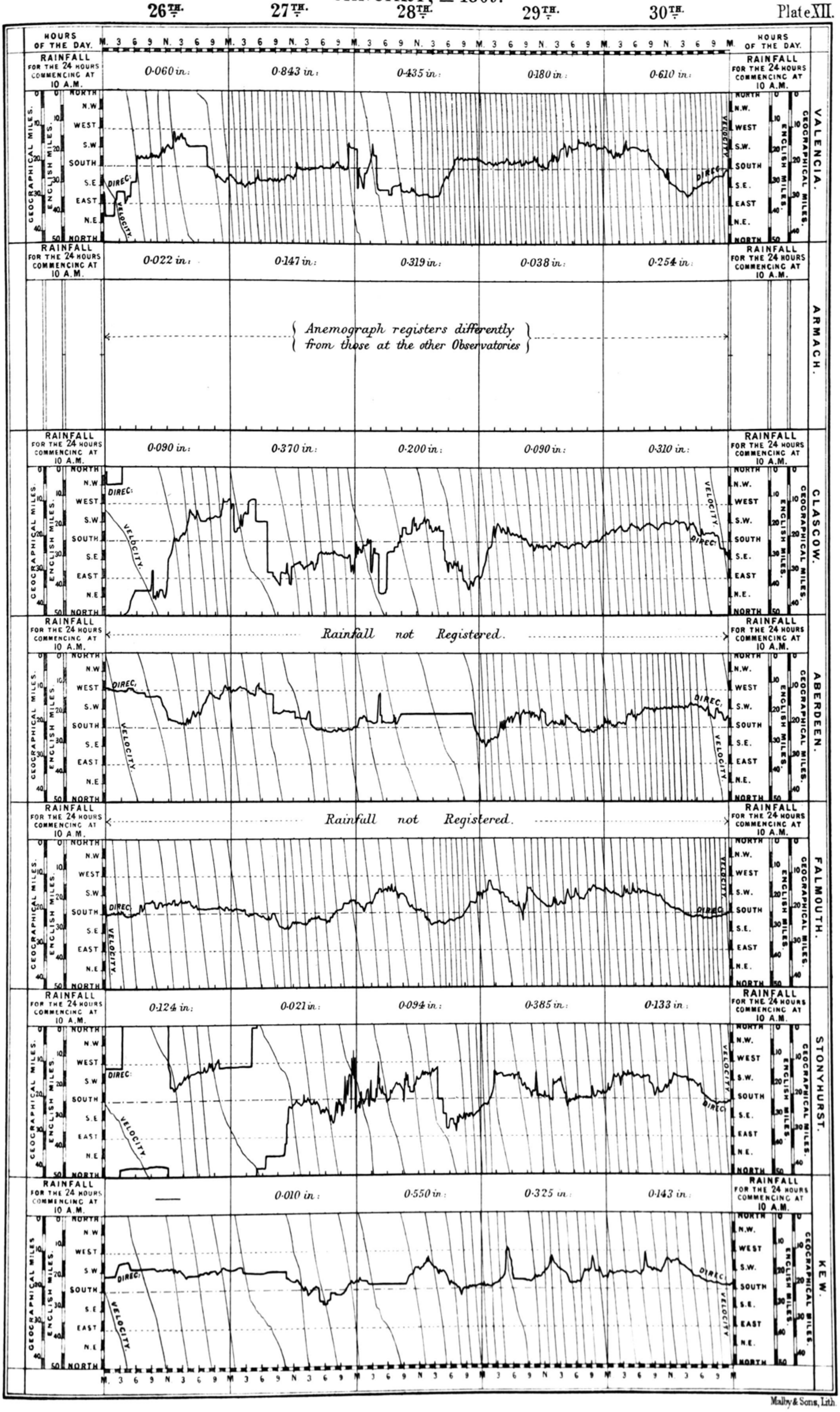

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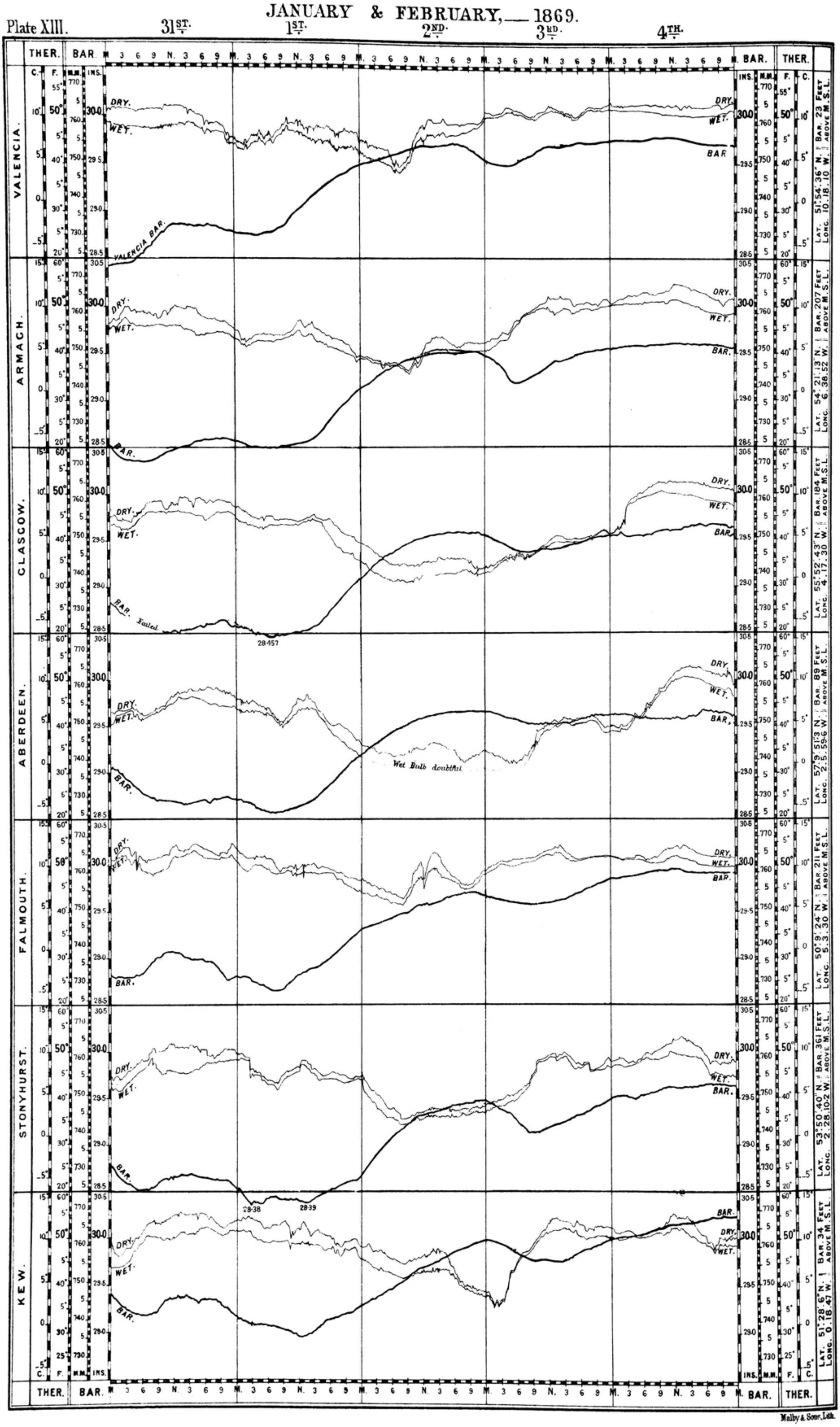
Plate XIII.

JANUARY & FEBRUARY,—1869.



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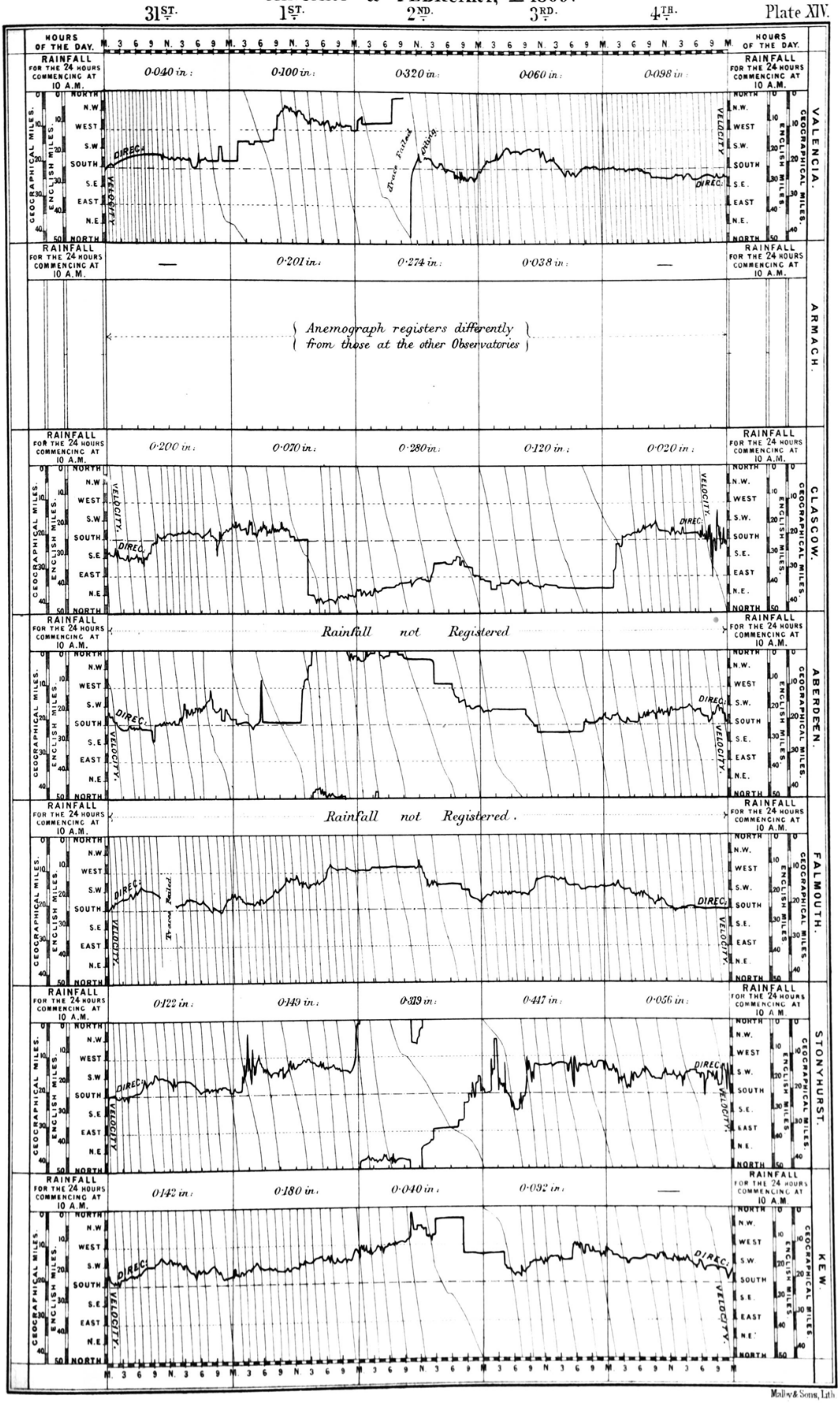
JANUARY & FEBRUARY, — 1869.

Plate XIV.



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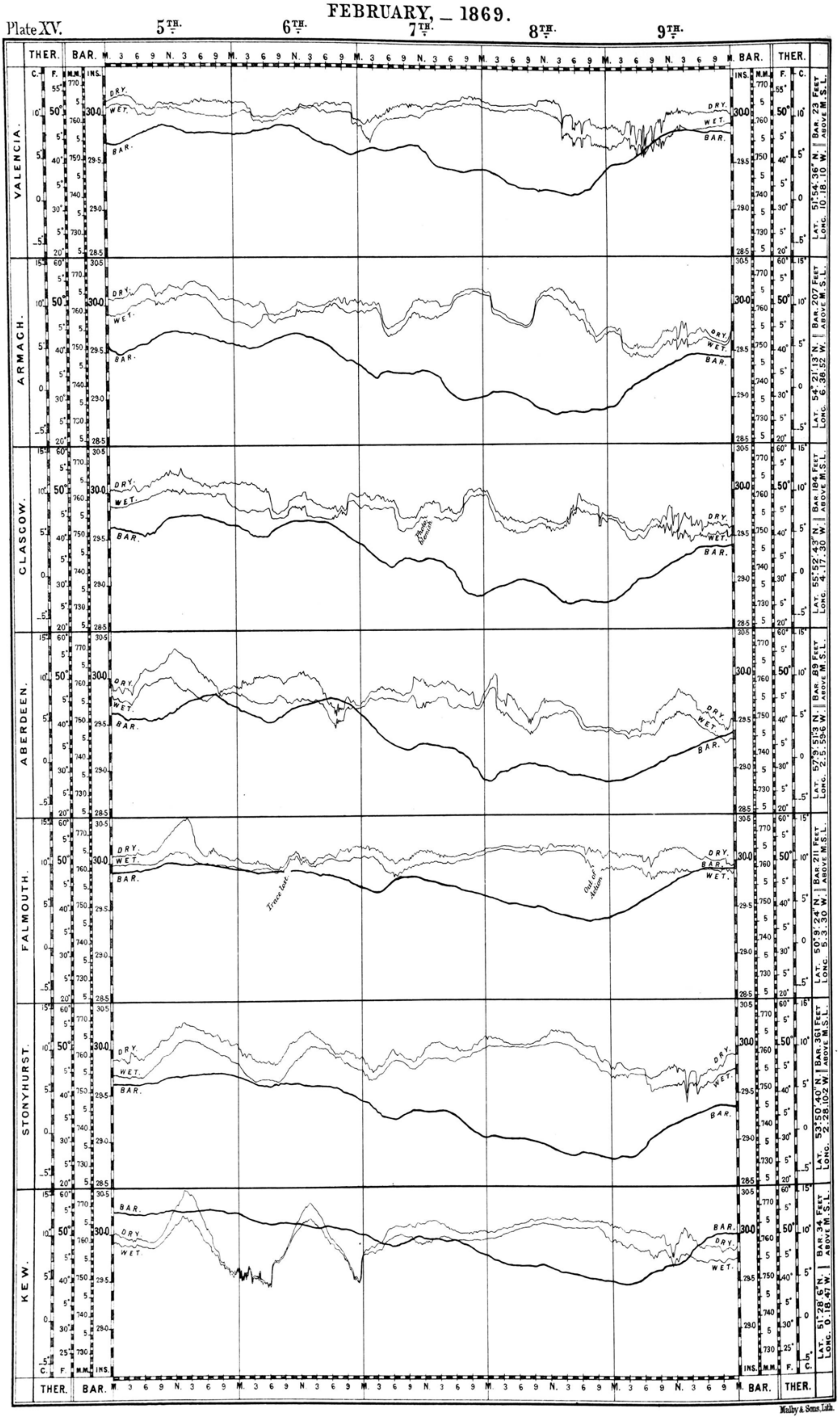

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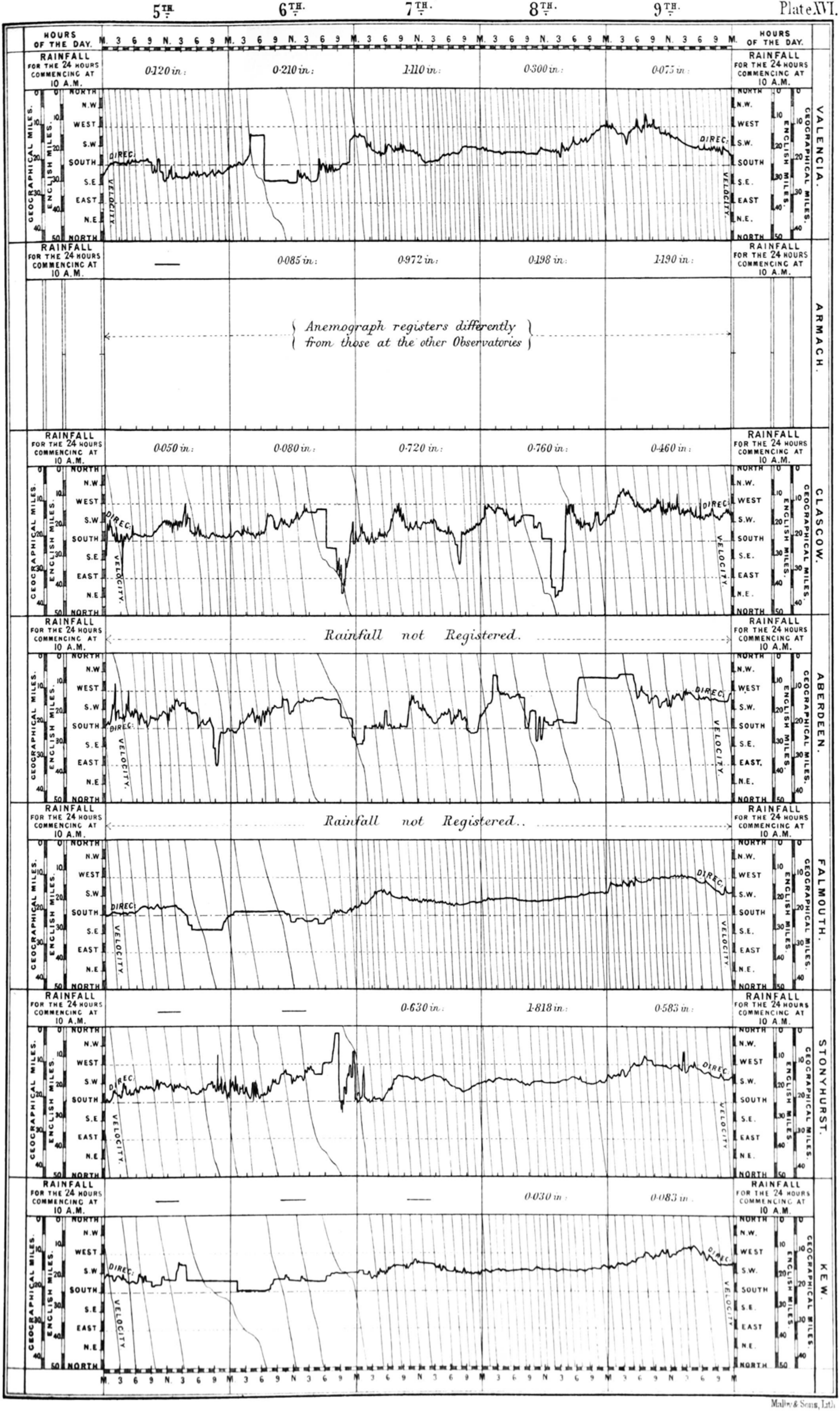
Plate XVI.



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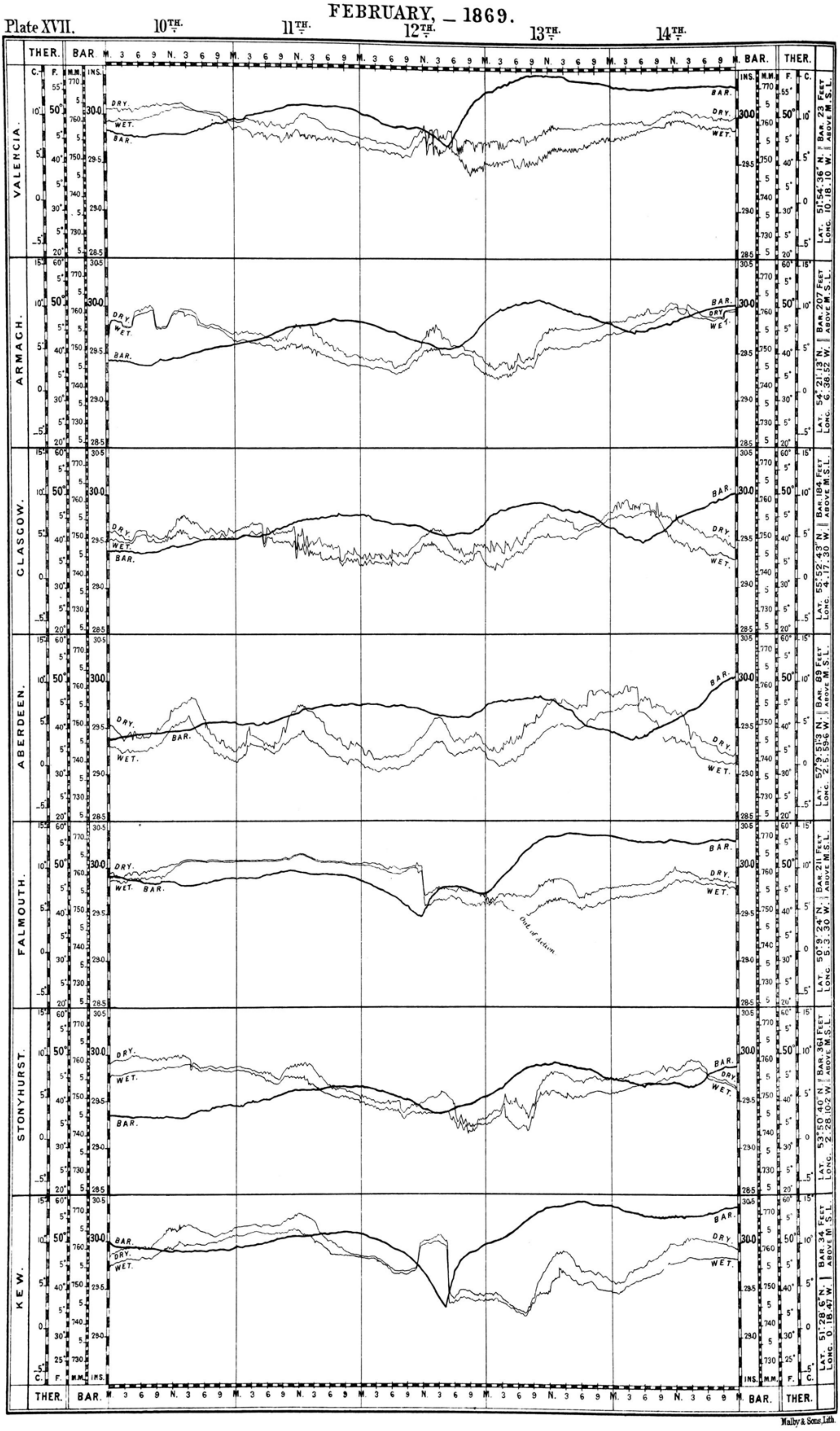

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FEBRUARY, —1869.

Plate XVIII.

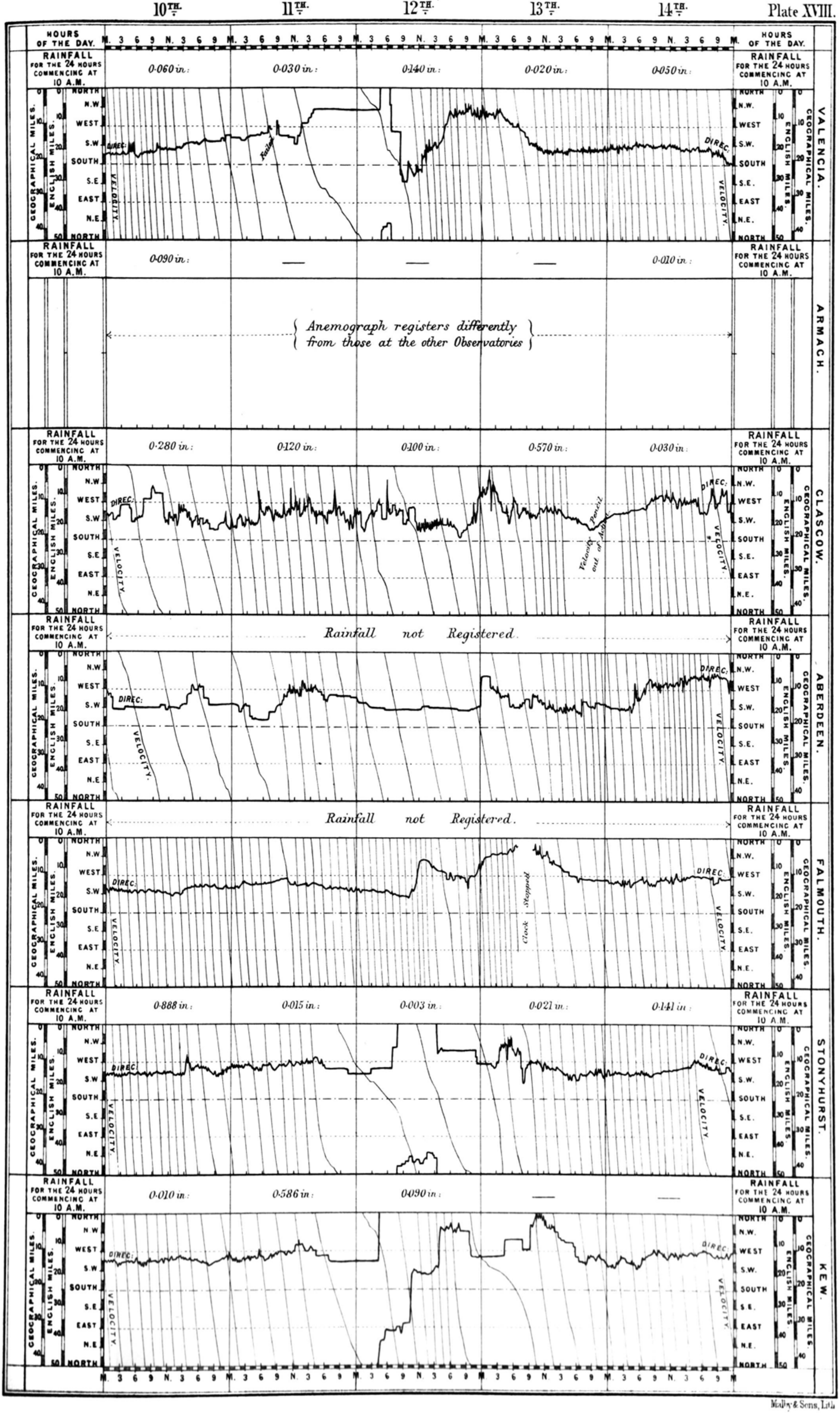

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Plate XIX.

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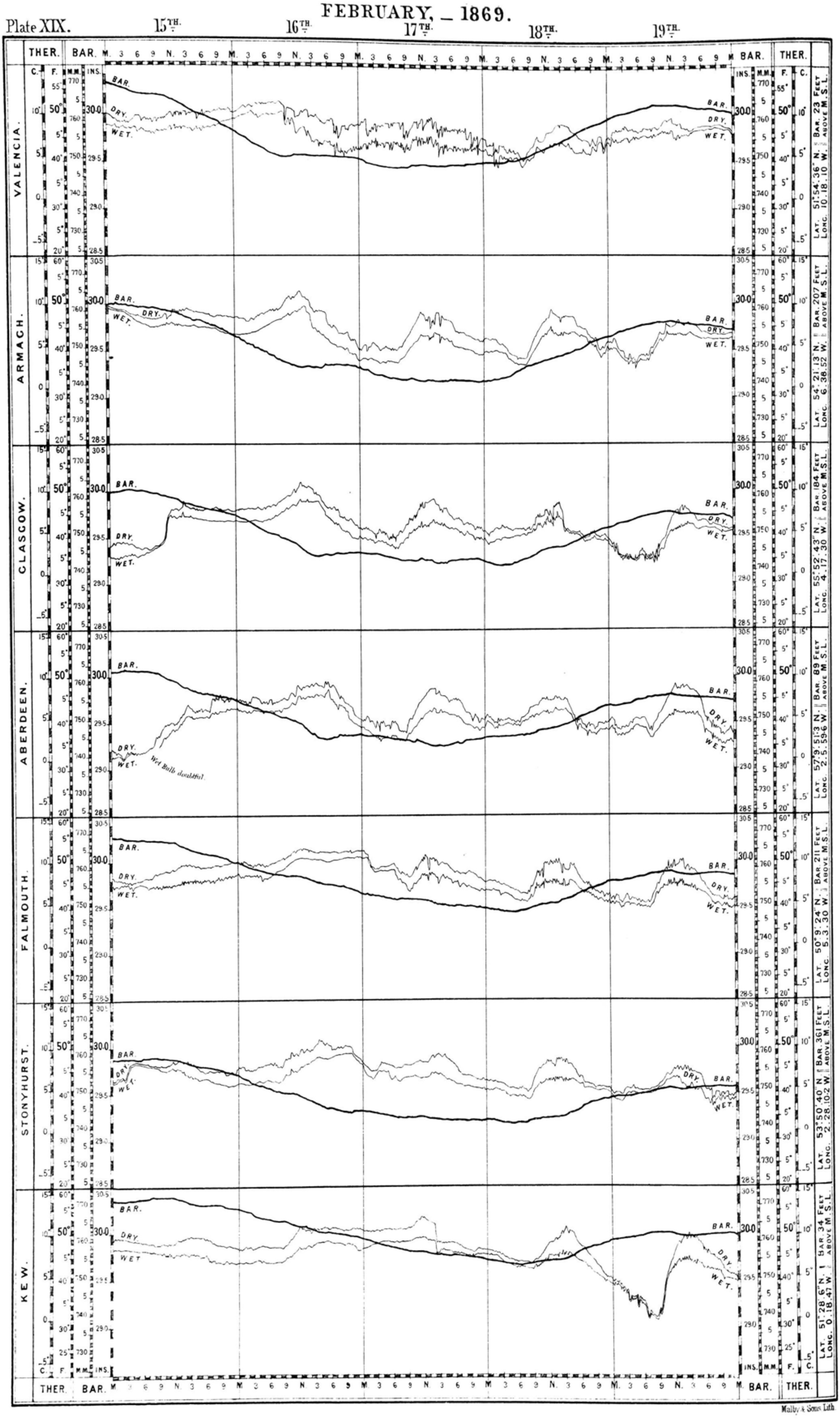

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Plate XX.

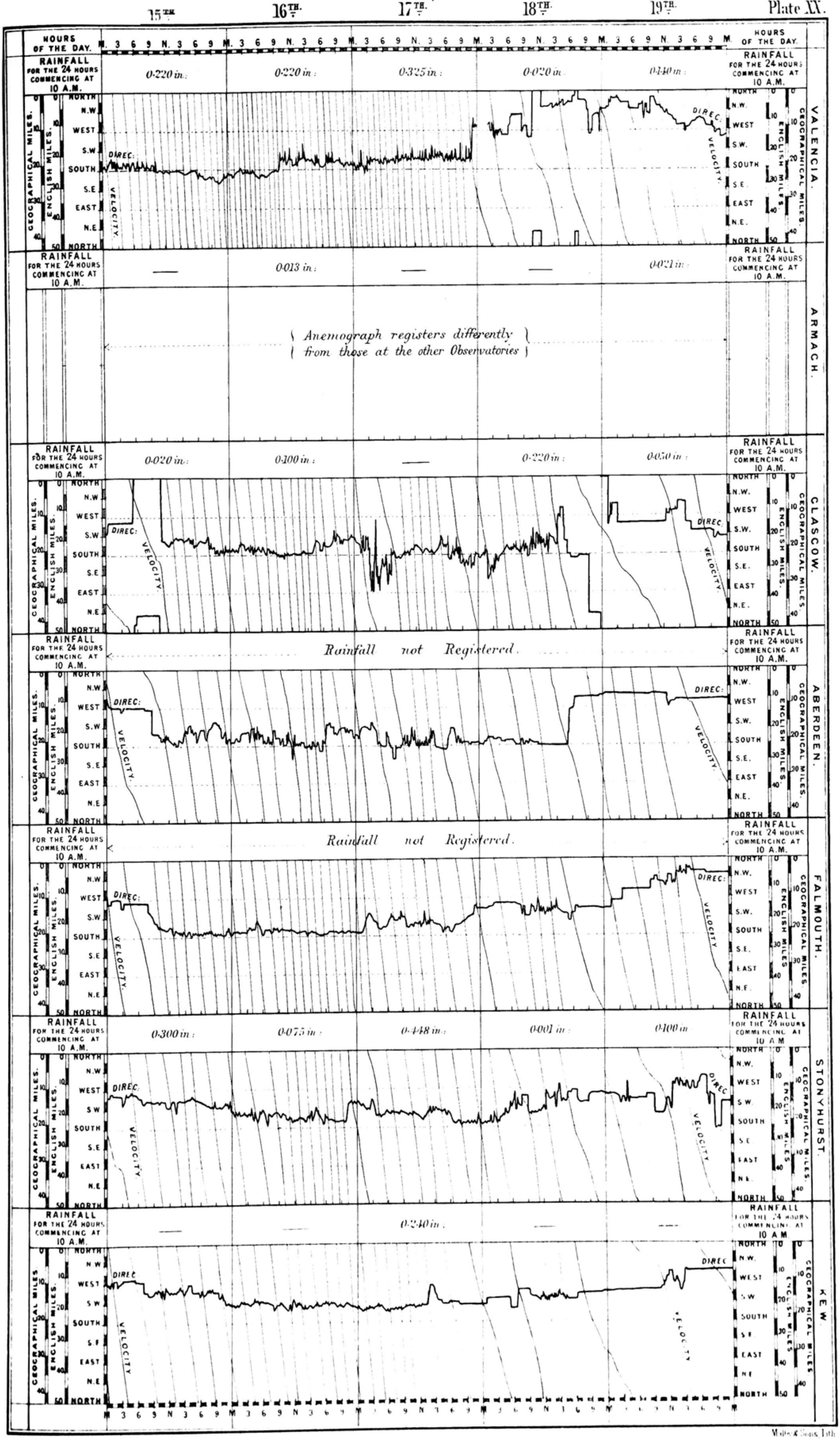

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Plate XXI.

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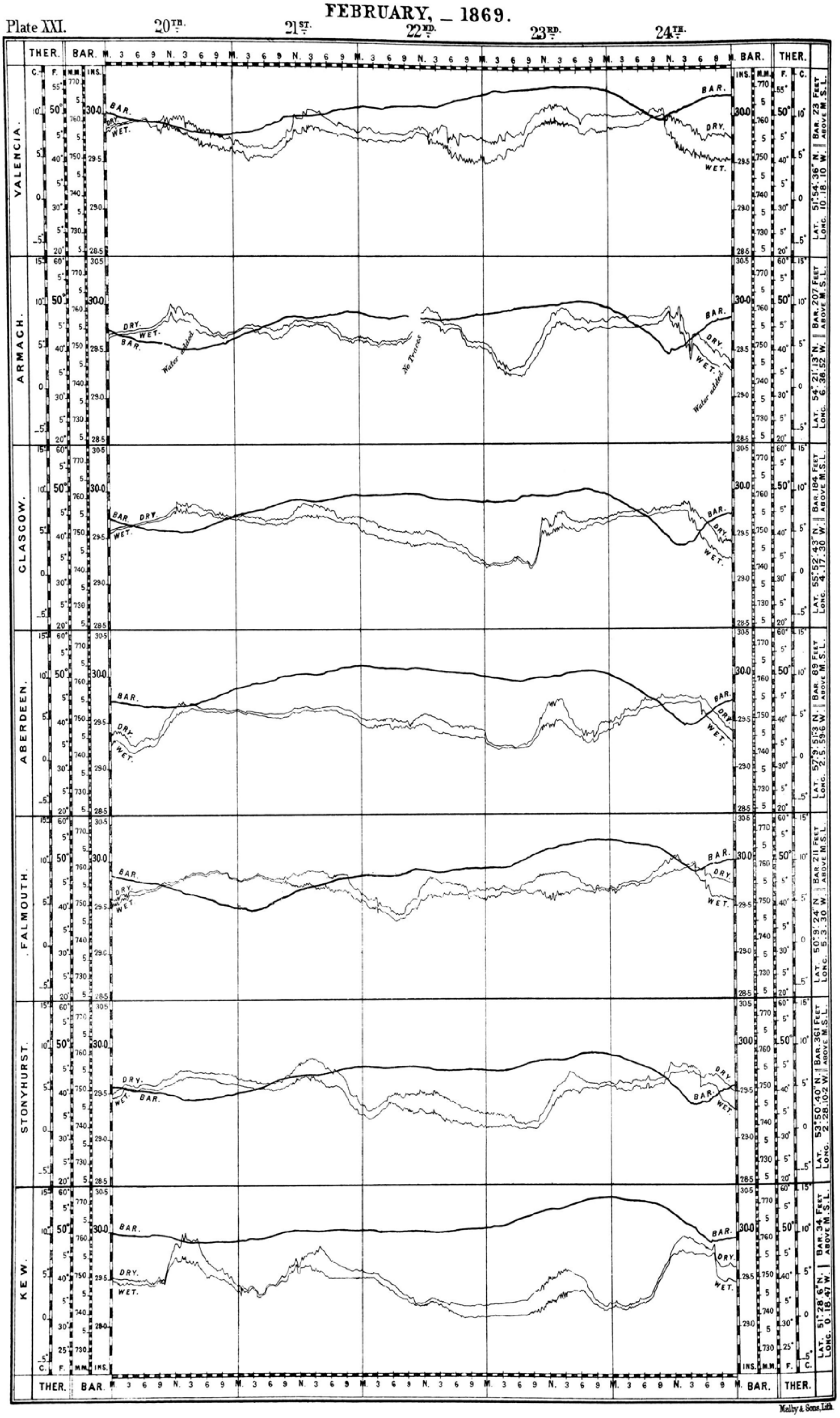

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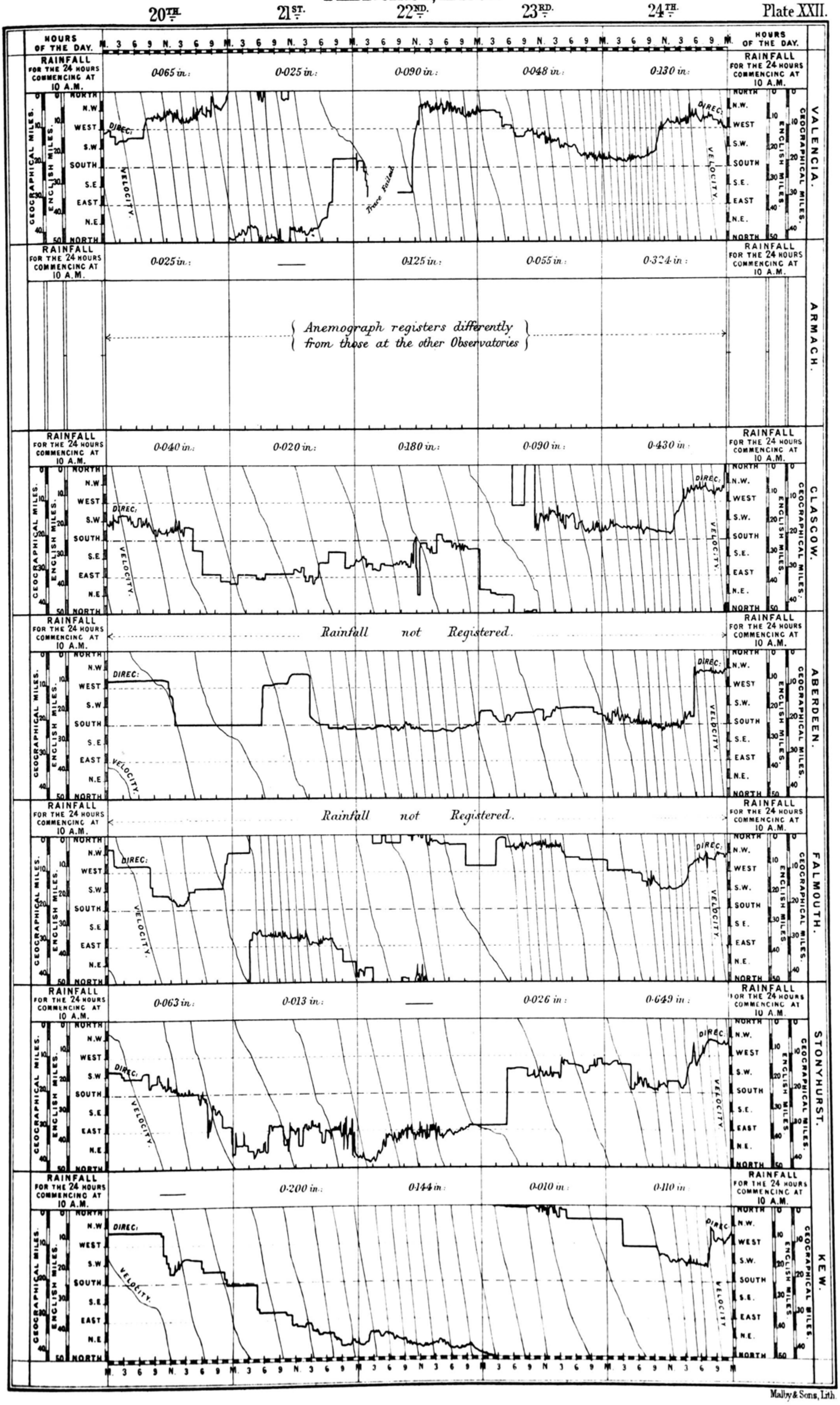

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Plate XXIII.

FEBRUARY & MARCH, — 1869.

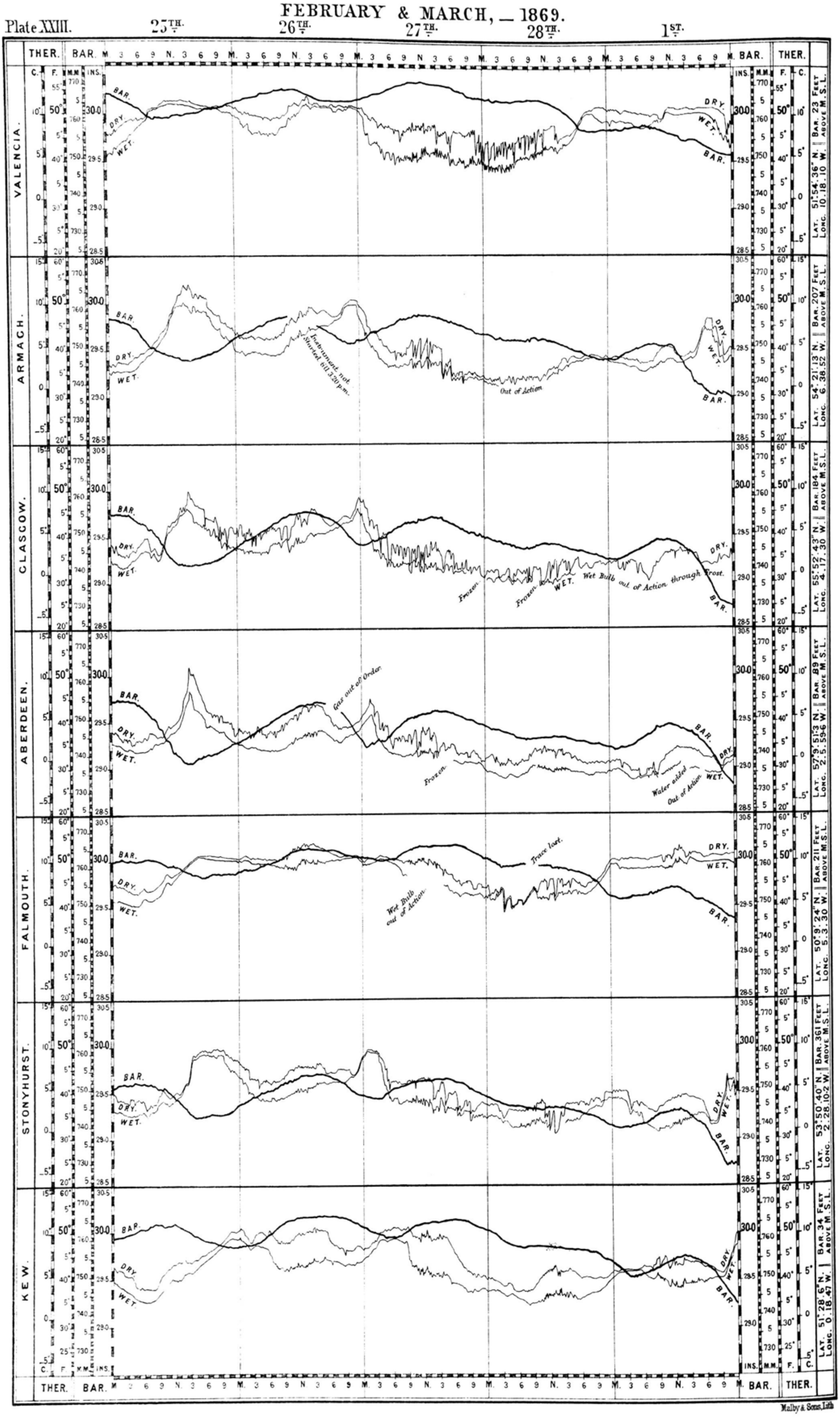

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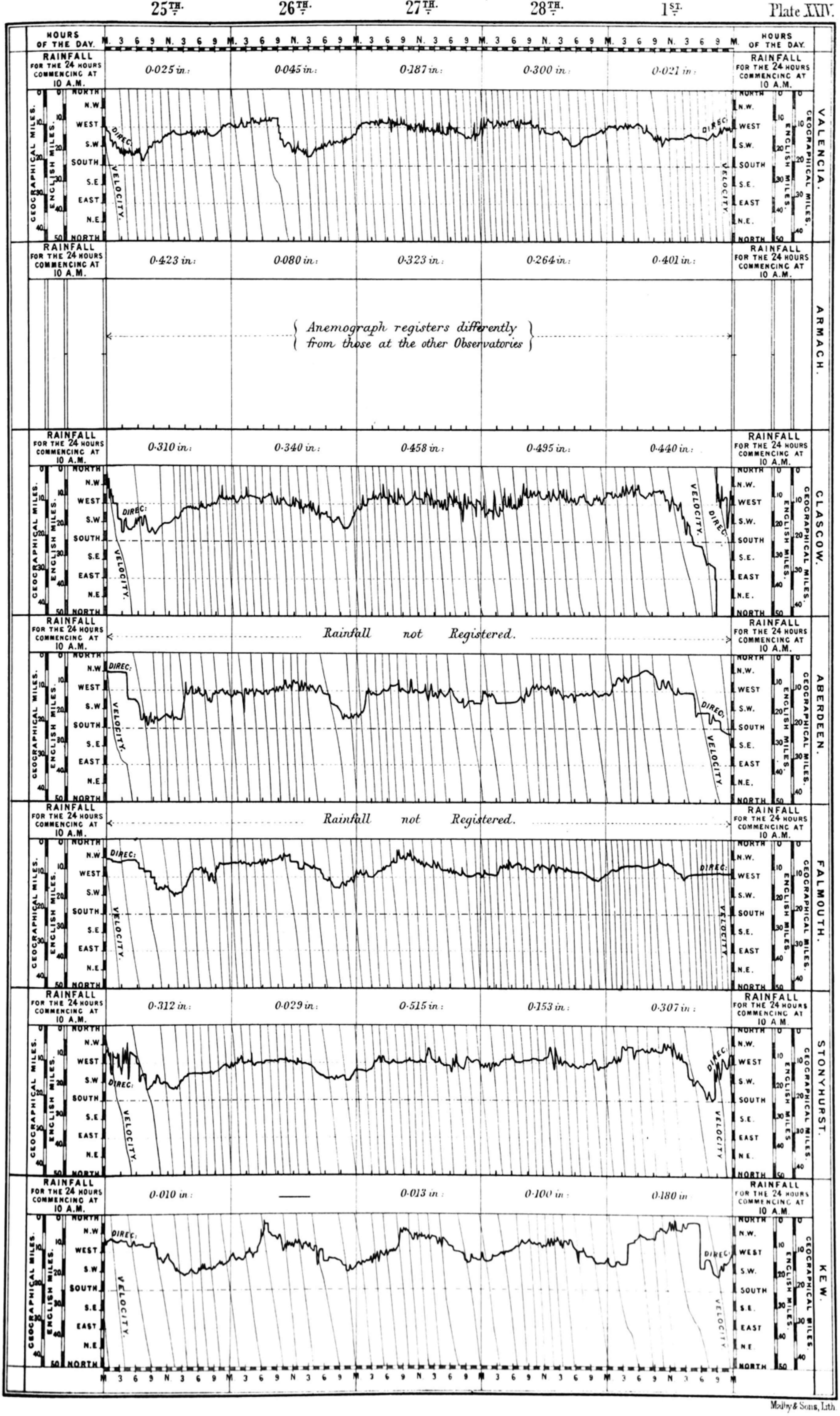
Plate XXIV.



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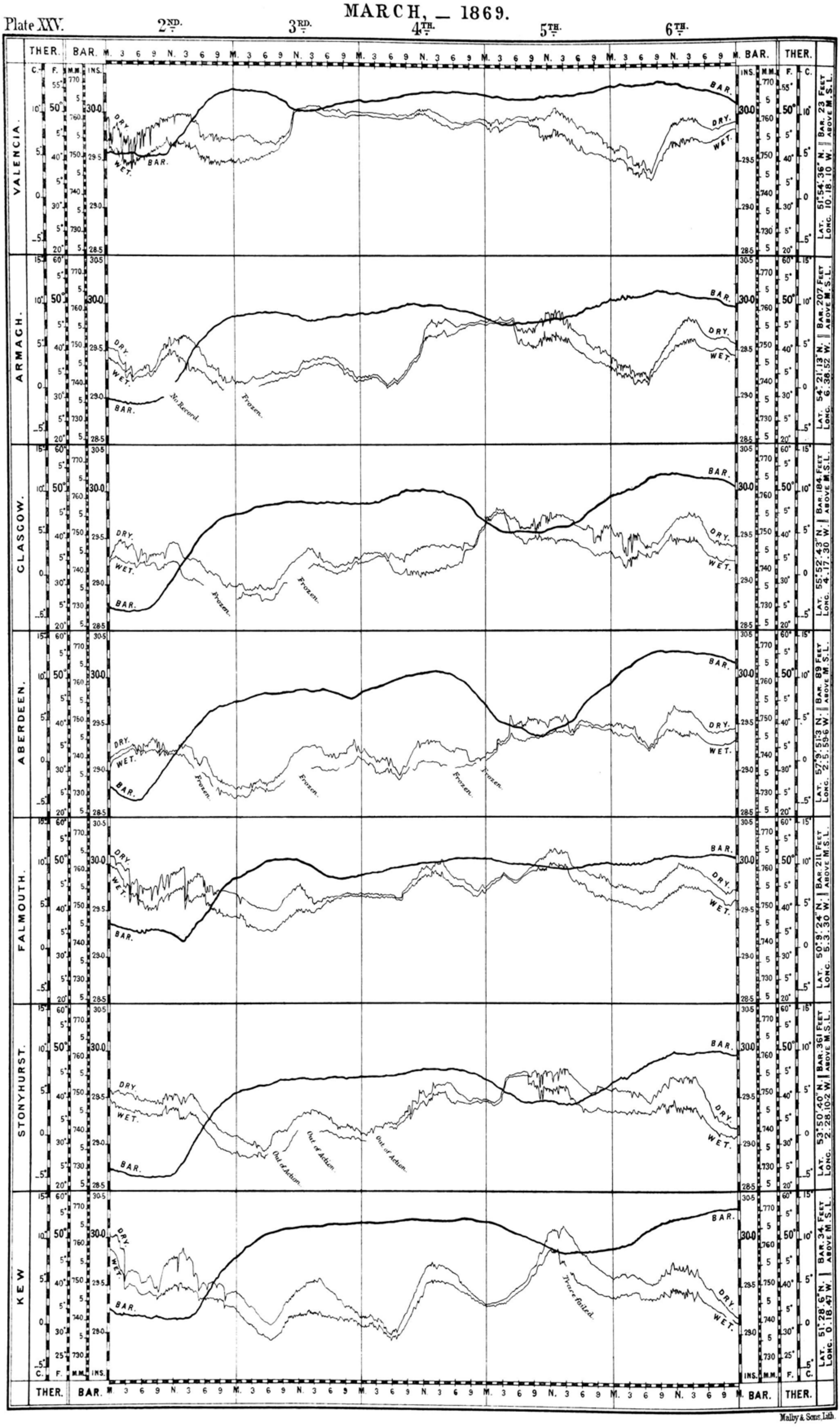
MARCH, — 1869.



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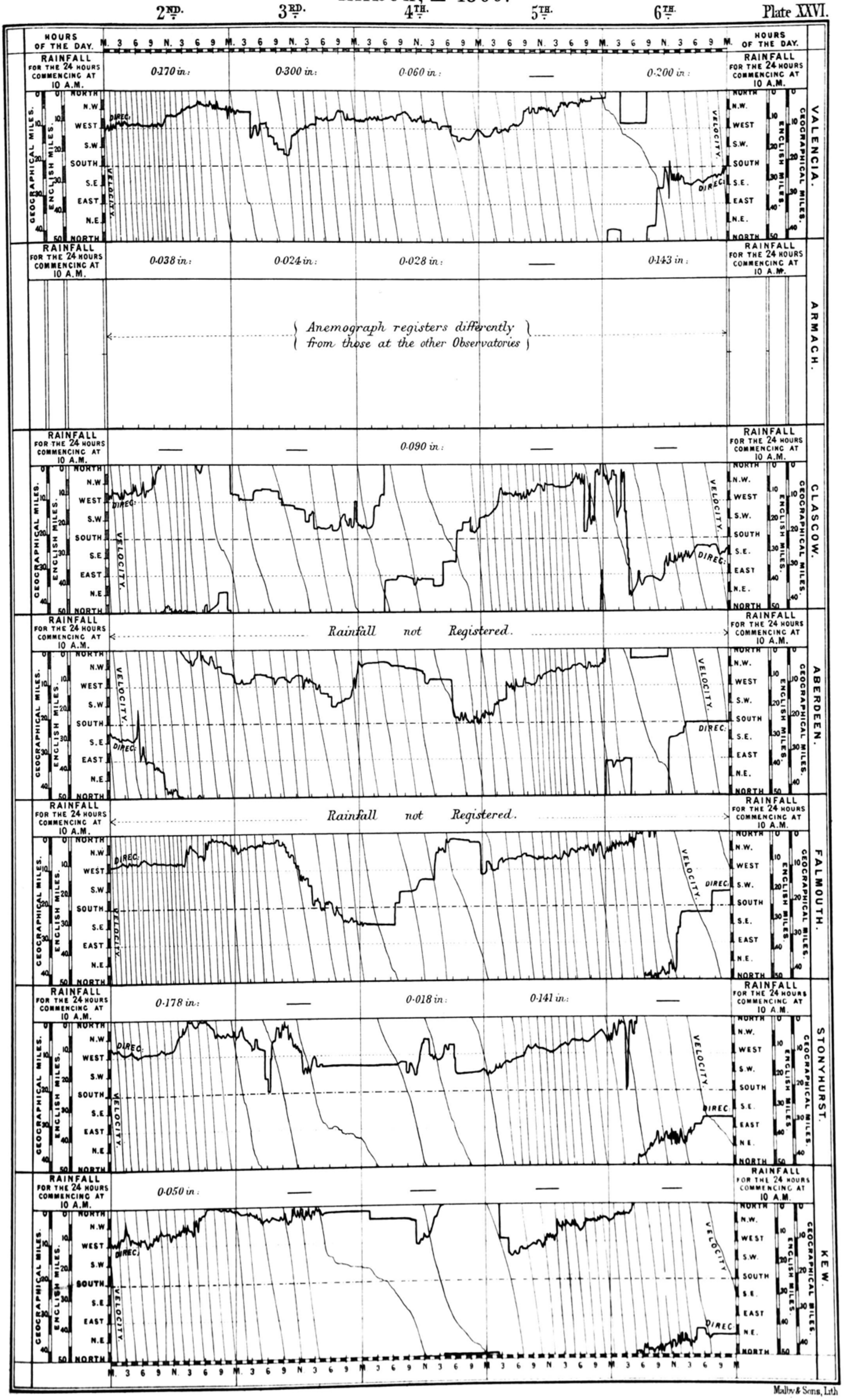
MARCH, — 1869.

Plate XXVI.



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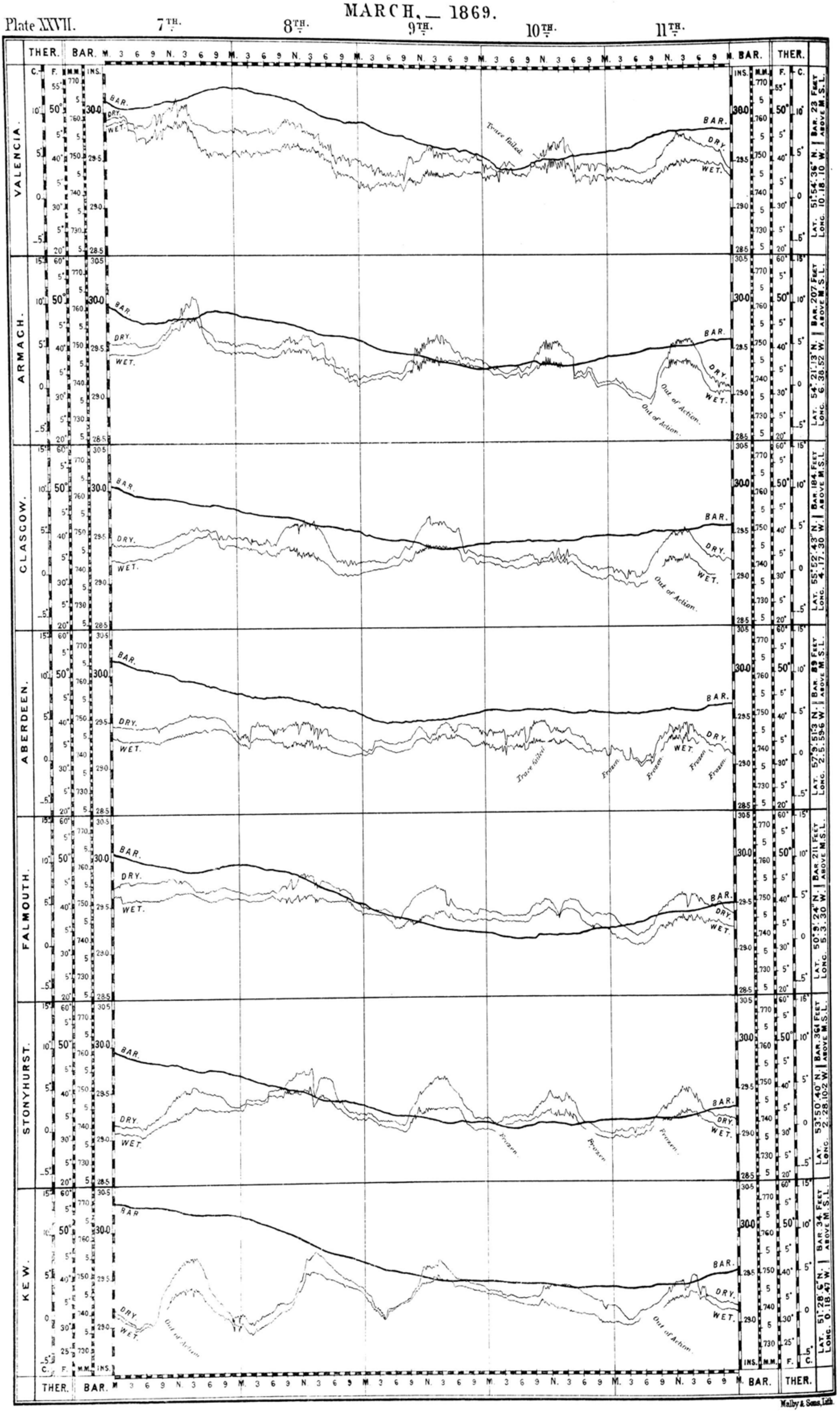

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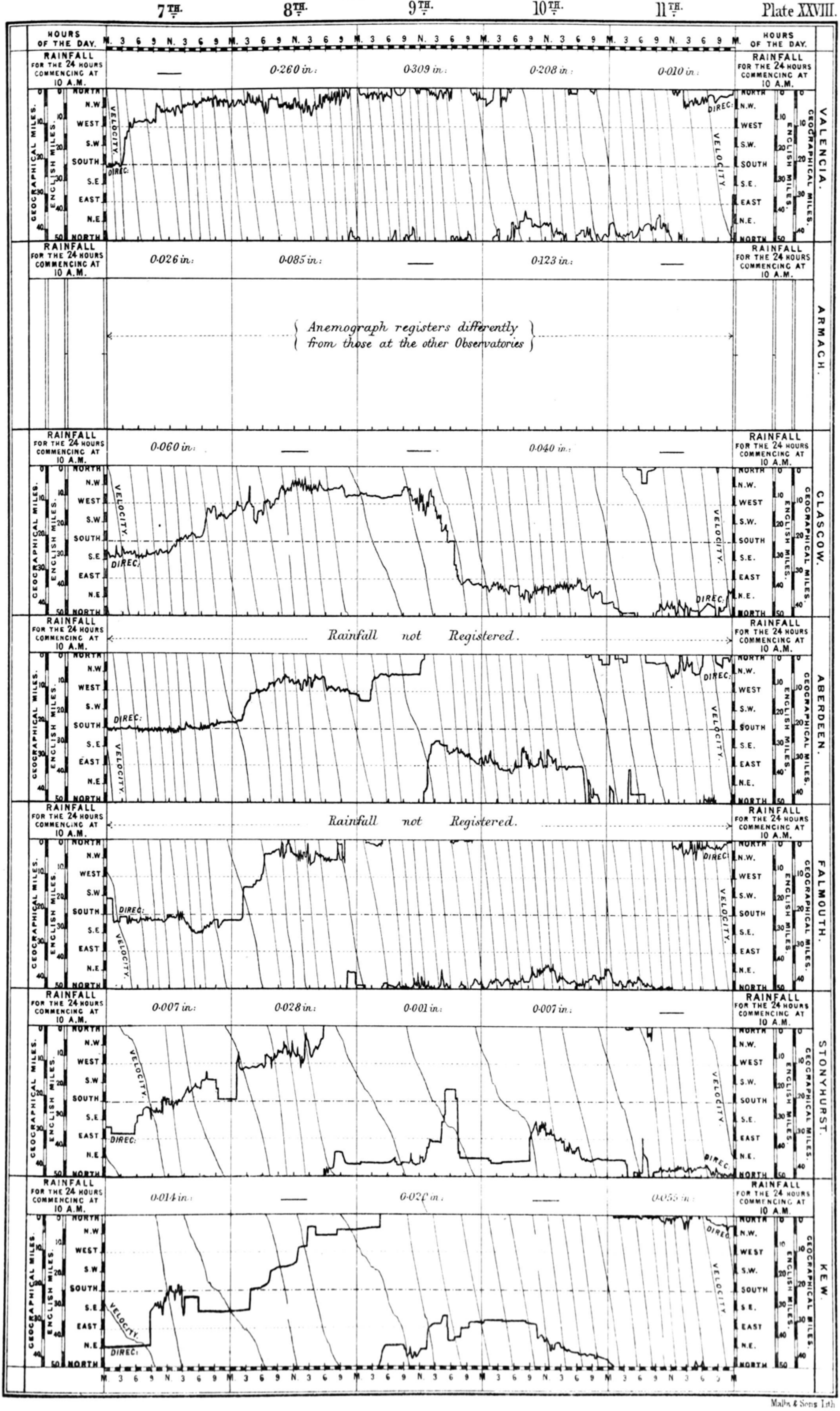
MARCH, — 1869.

Plate XXVIII.



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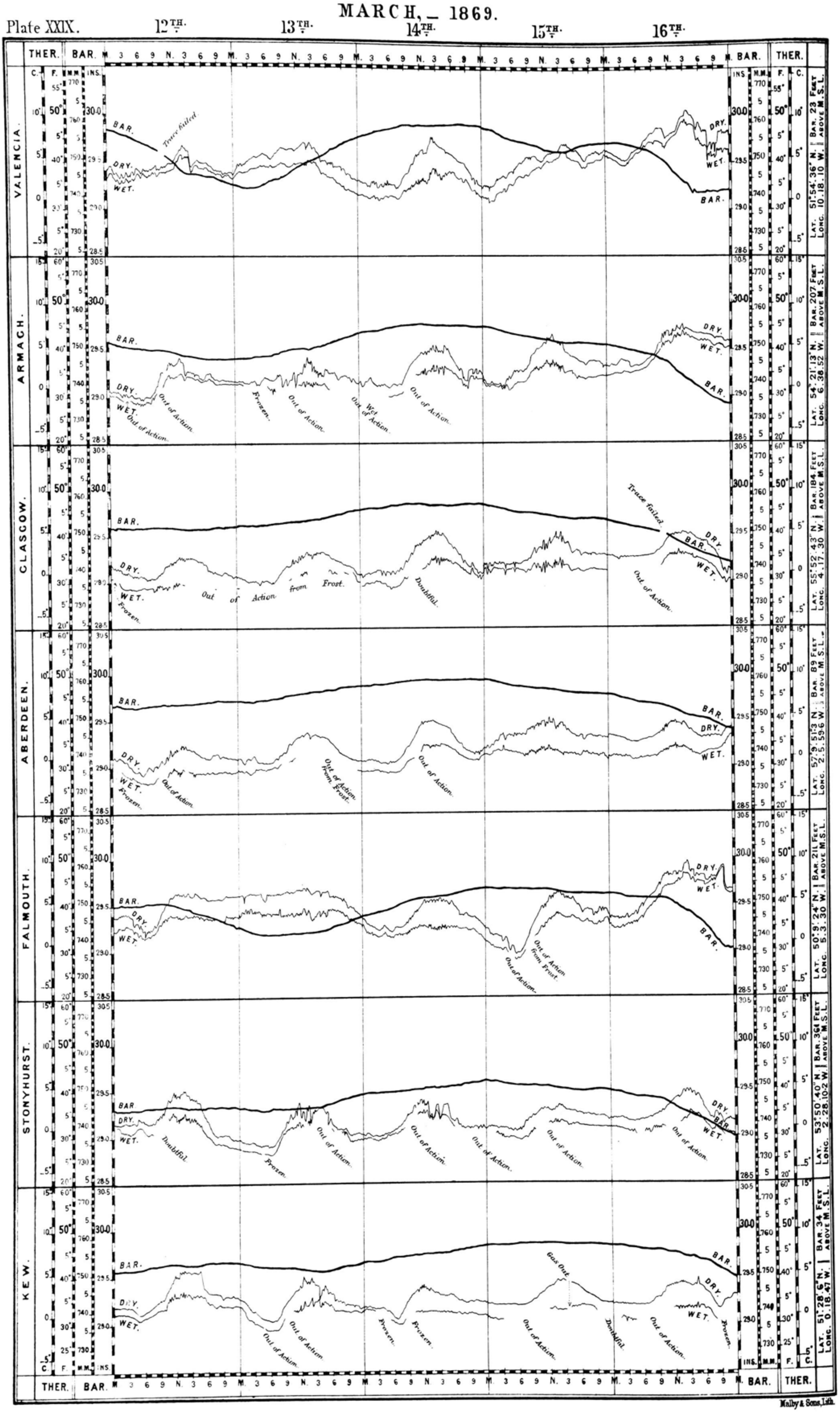
MARCH, — 1869.



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MARCH, — 1869.

Plate XXX.

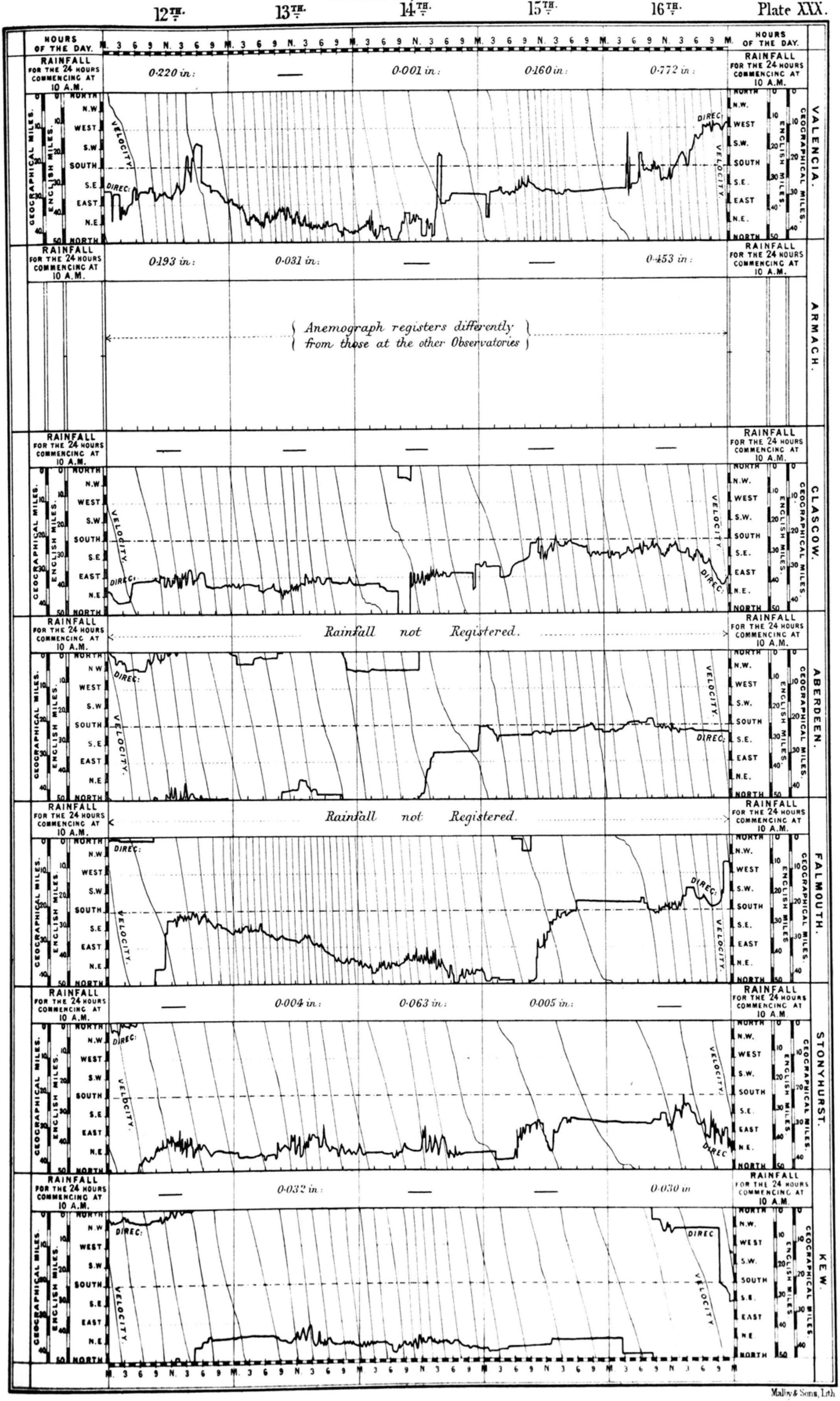

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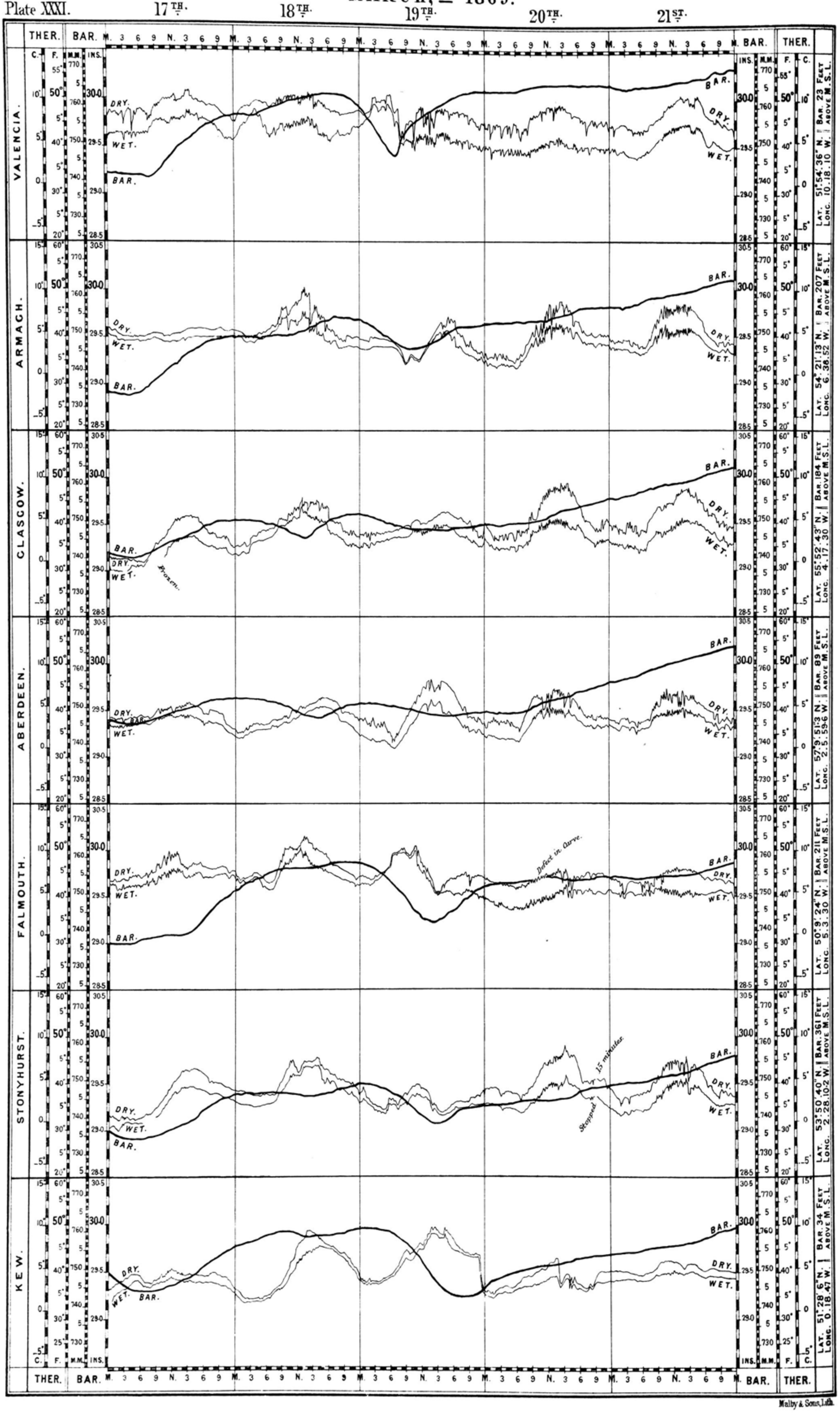
Plate XXXI.

MARCH, — 1869.



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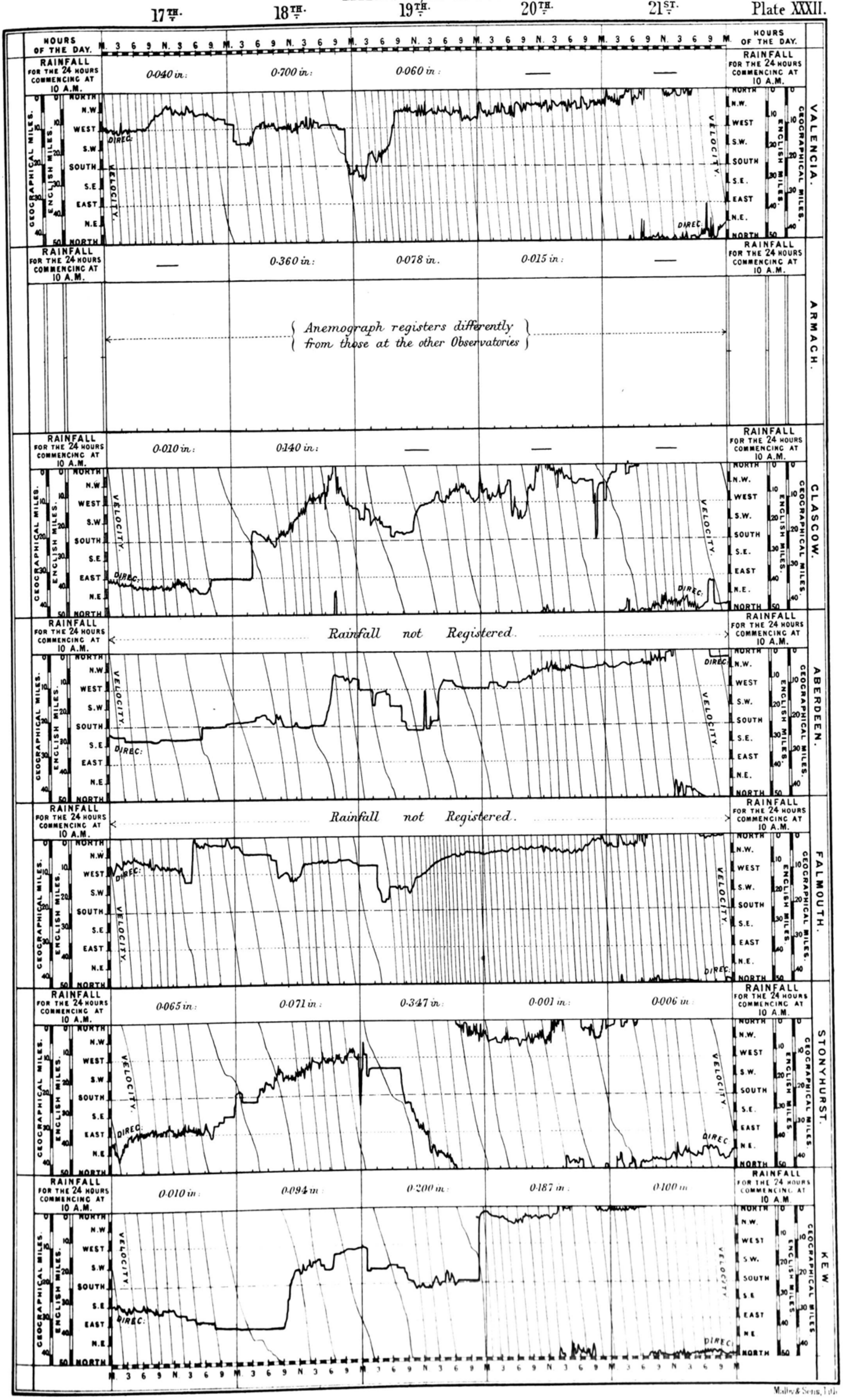
MARCH, — 1869.

Plate XXXII.

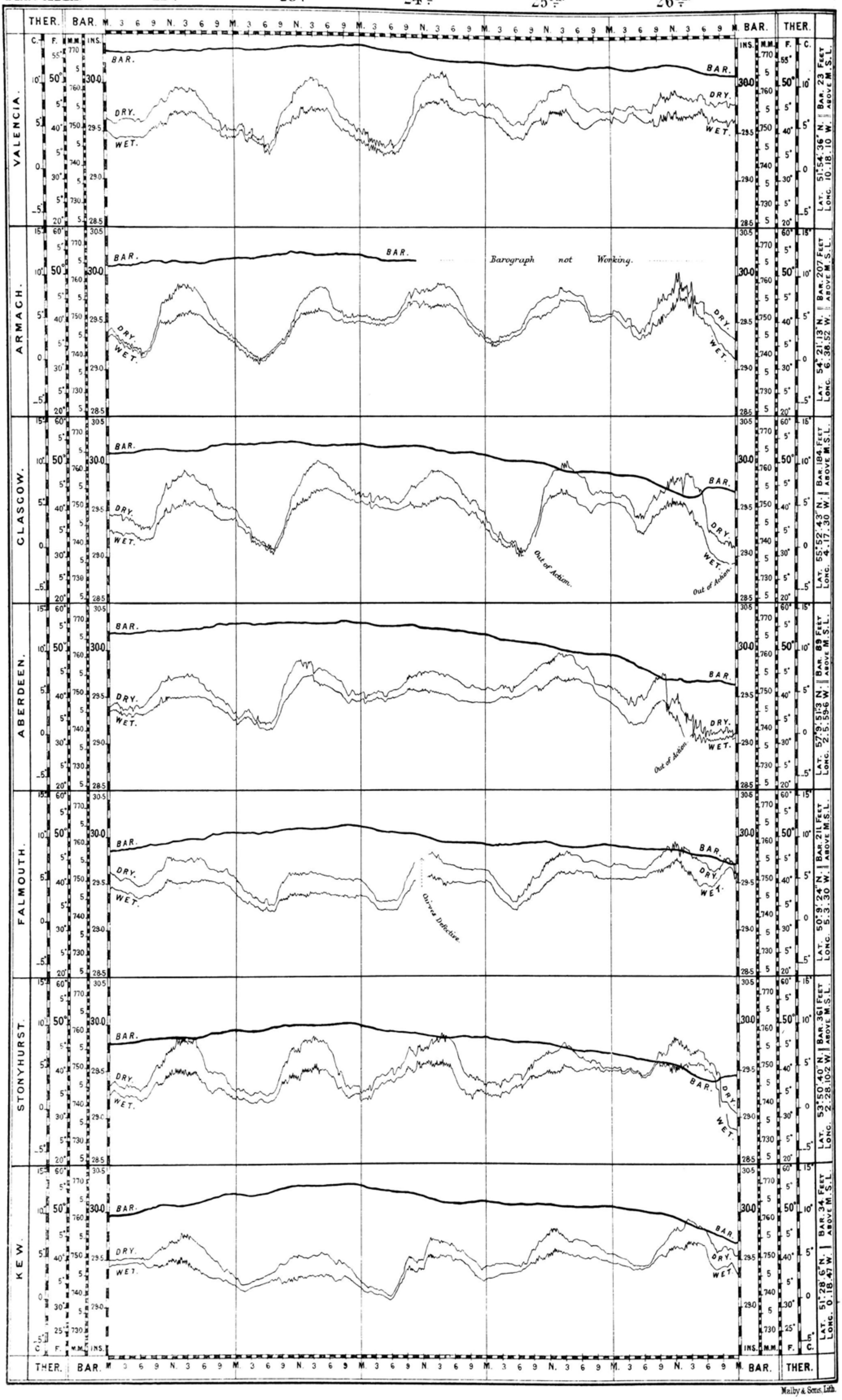


Malby & Sons, Lith.

Plate XXXIII.

MARCH, — 1869.

22nd. 23rd. 24th. 25th. 26th.



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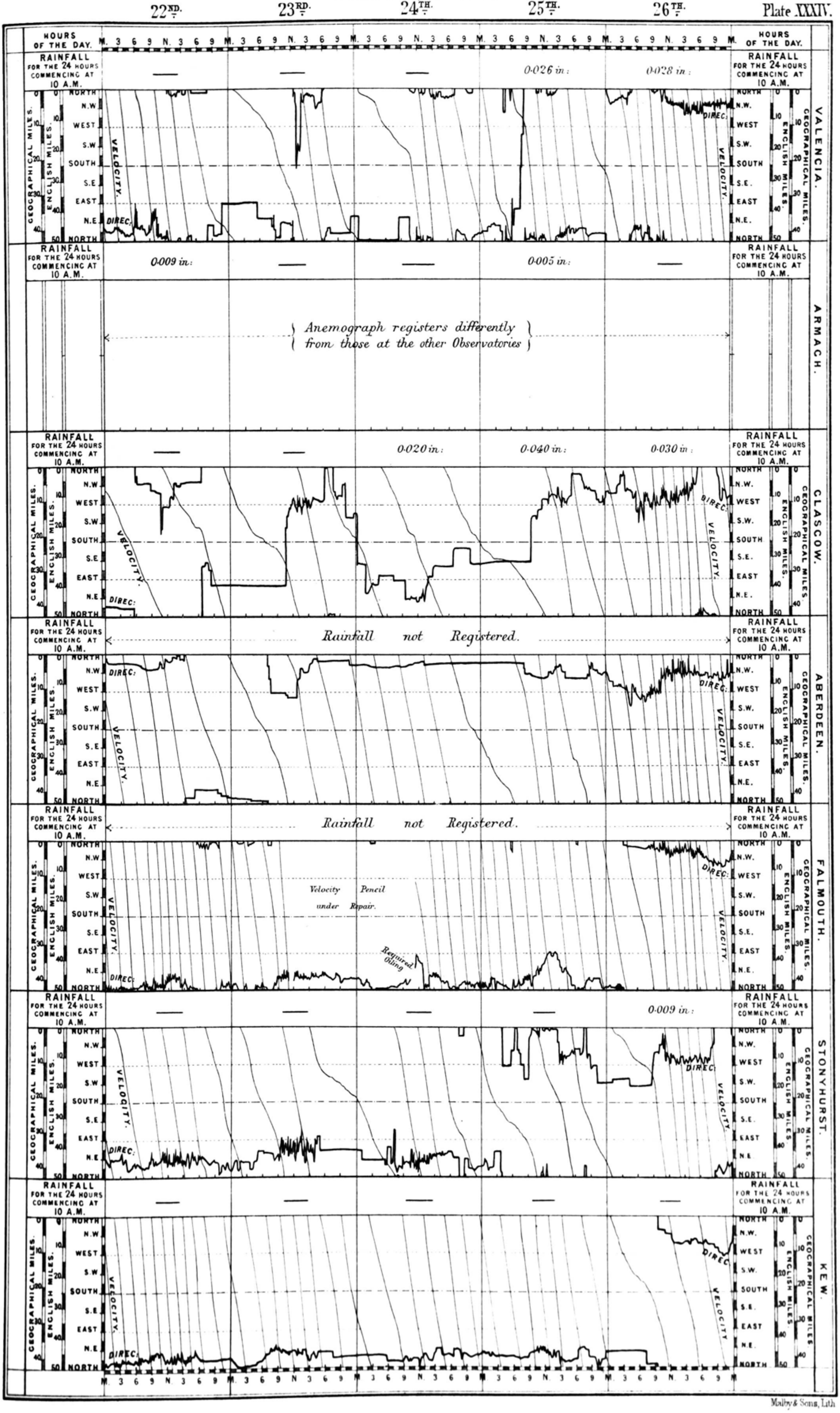
MARCH, — 1869.

Plate XXXIV.



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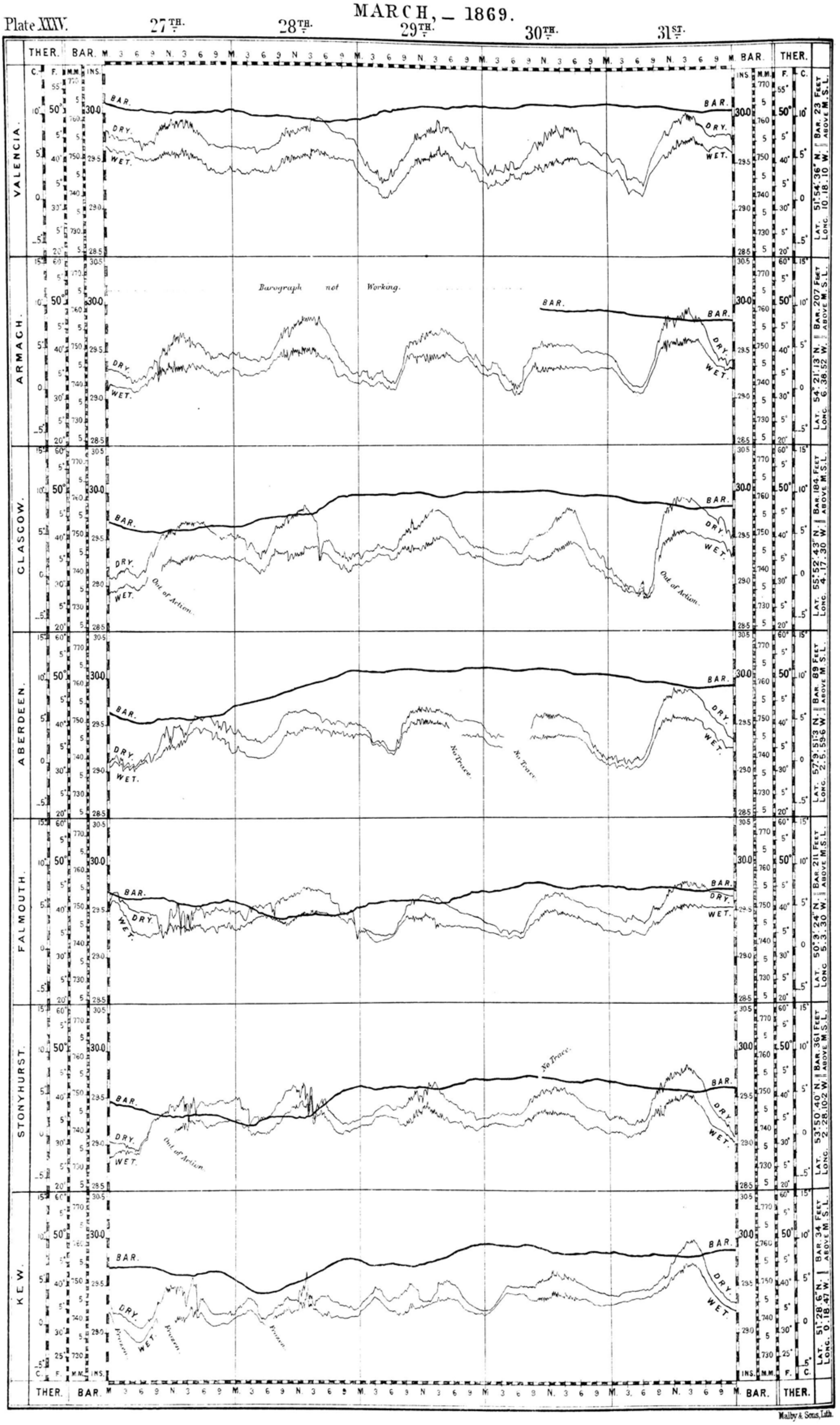

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MARCH, — 1869.

Plate XXXVI.

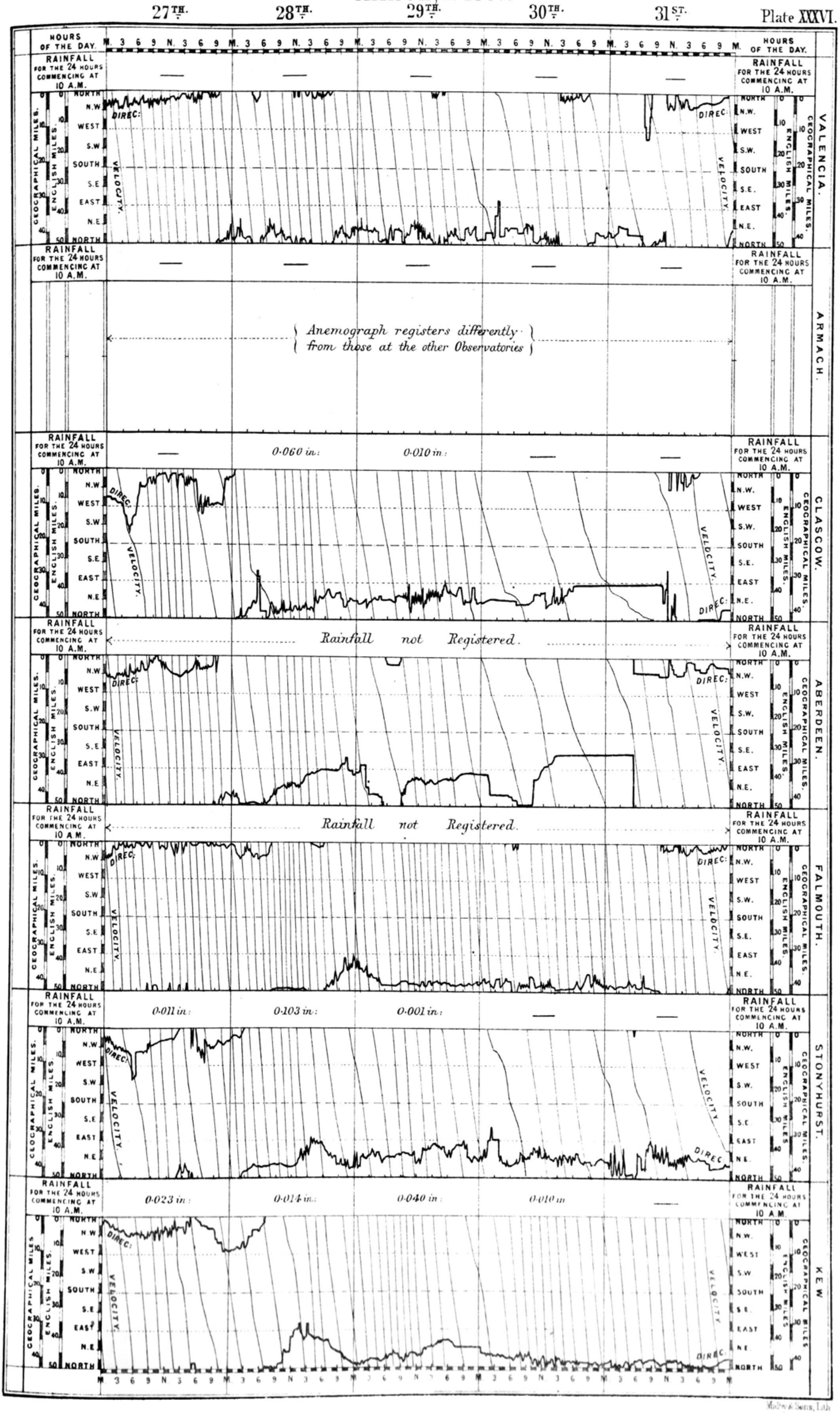

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Plate XXXVII.

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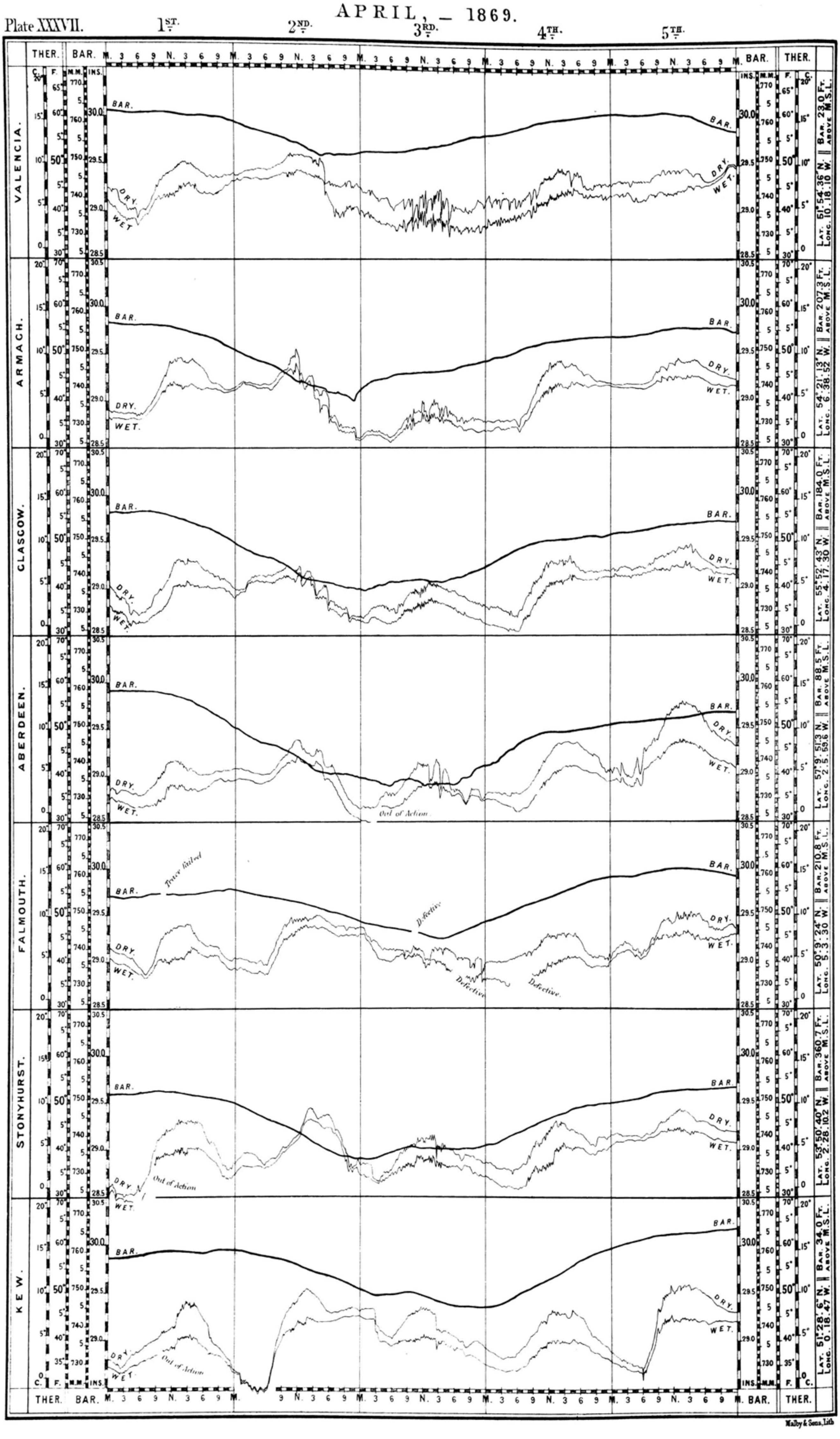
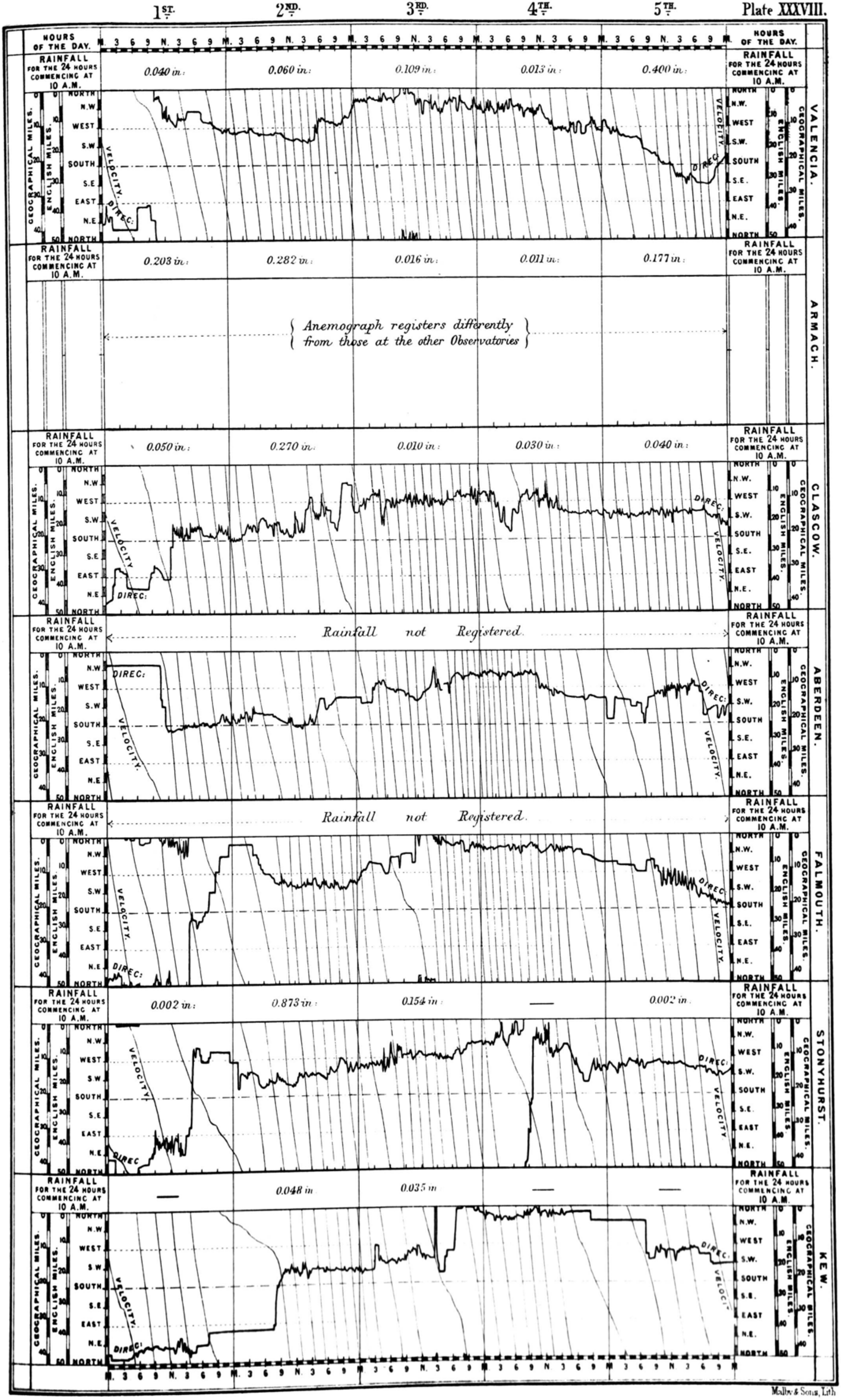


Maltby & Sons, Lith.

APRIL, _ 1869.

Plate XXXVIII.



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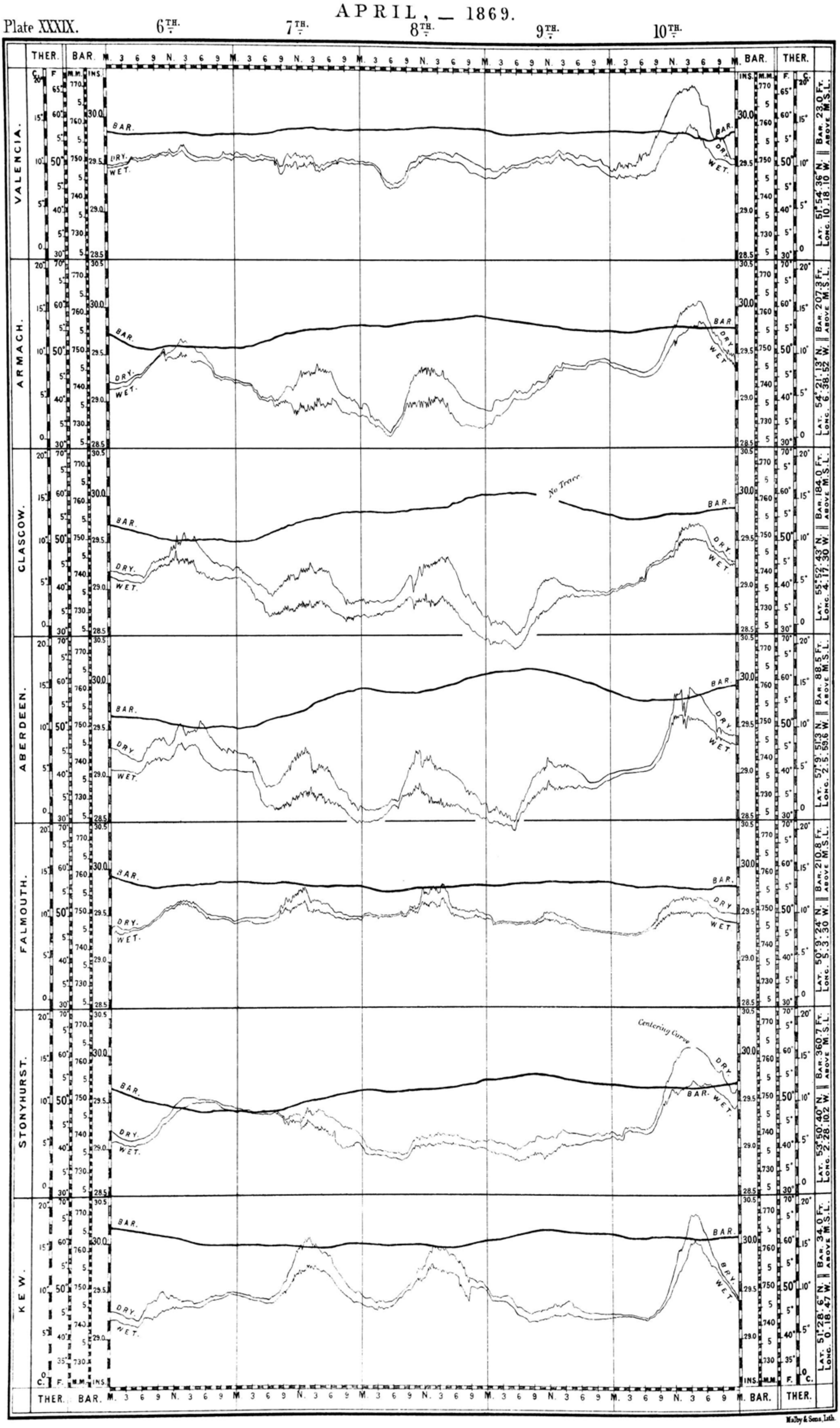
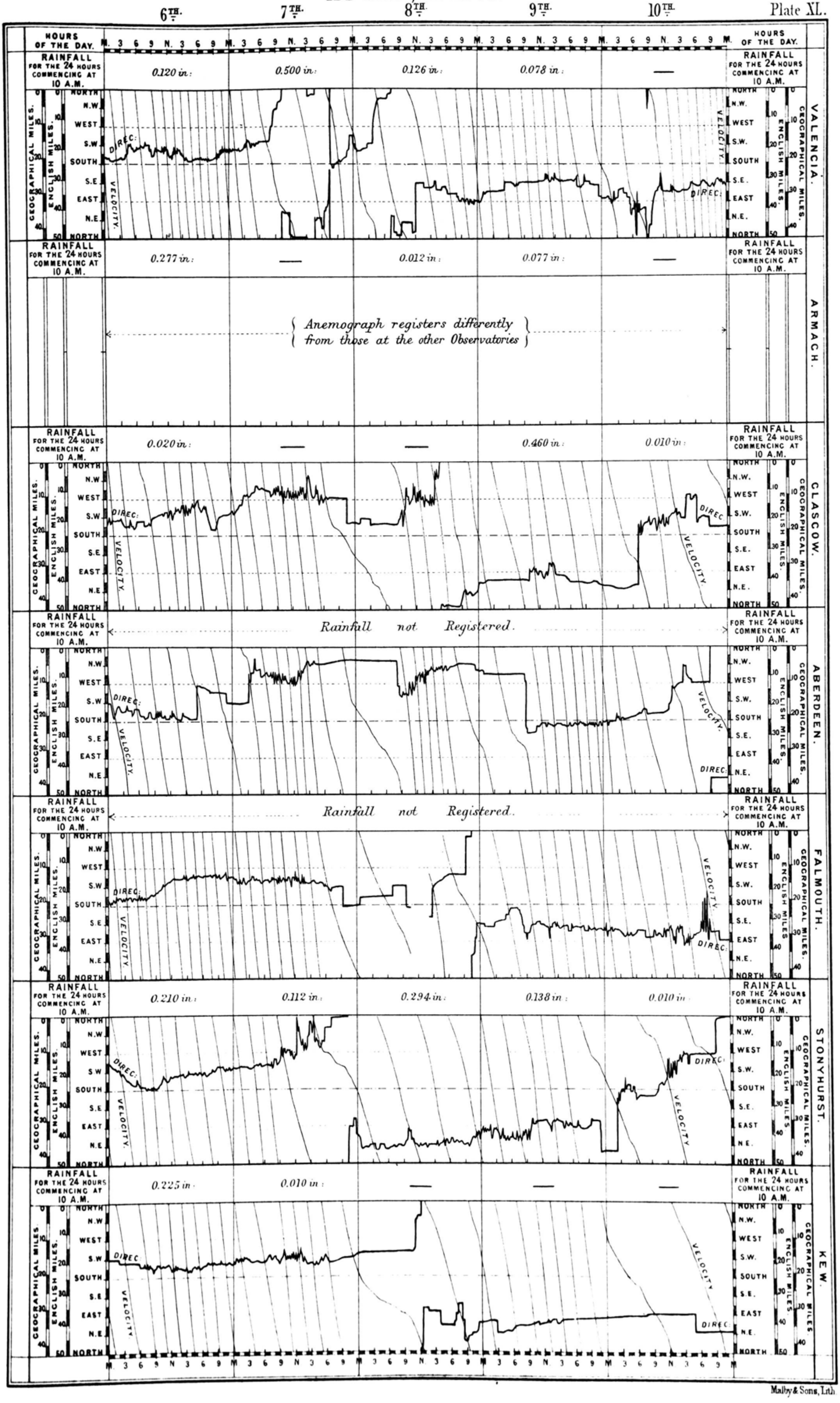


Malby & Sons, Lith.

APRIL, — 1869.

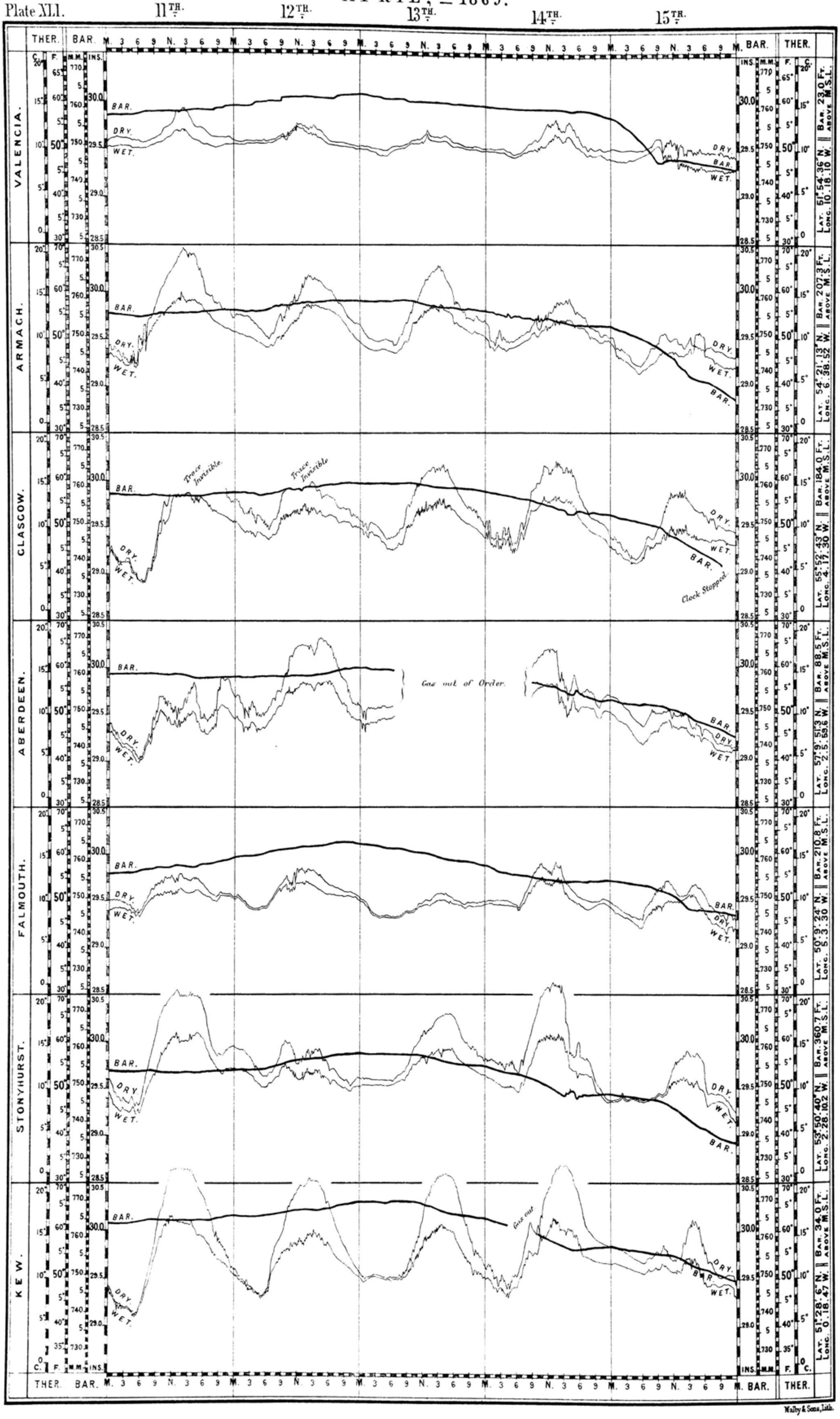
Plate XL.



Malby & Sons, Lith.

Plate XLI.

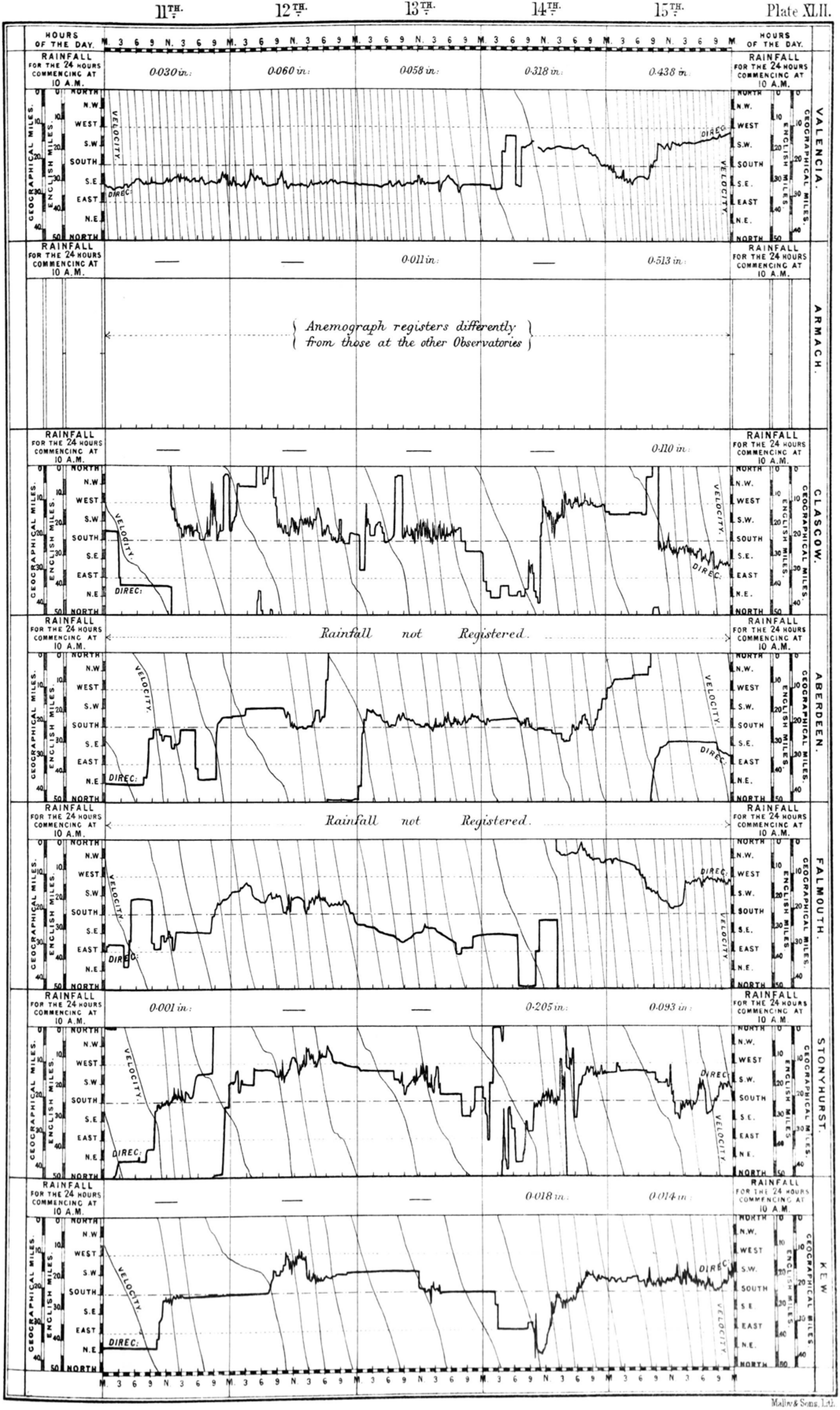
APRIL, — 1869.



Walby & Sons, Lith.

APRIL, — 1869.

Plate XLII.



Maclure & Sons, Lith.

Plate XLIII.

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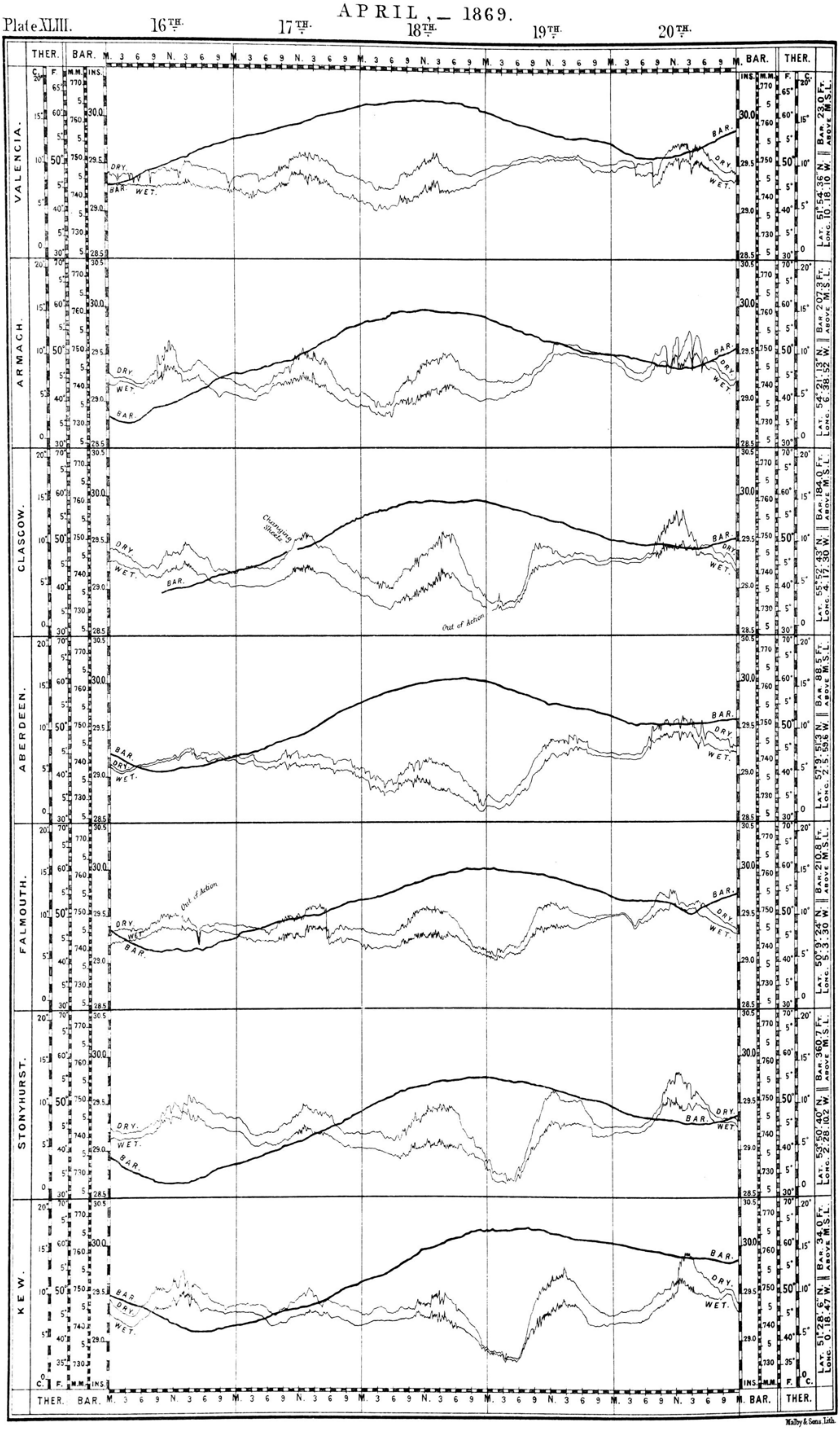
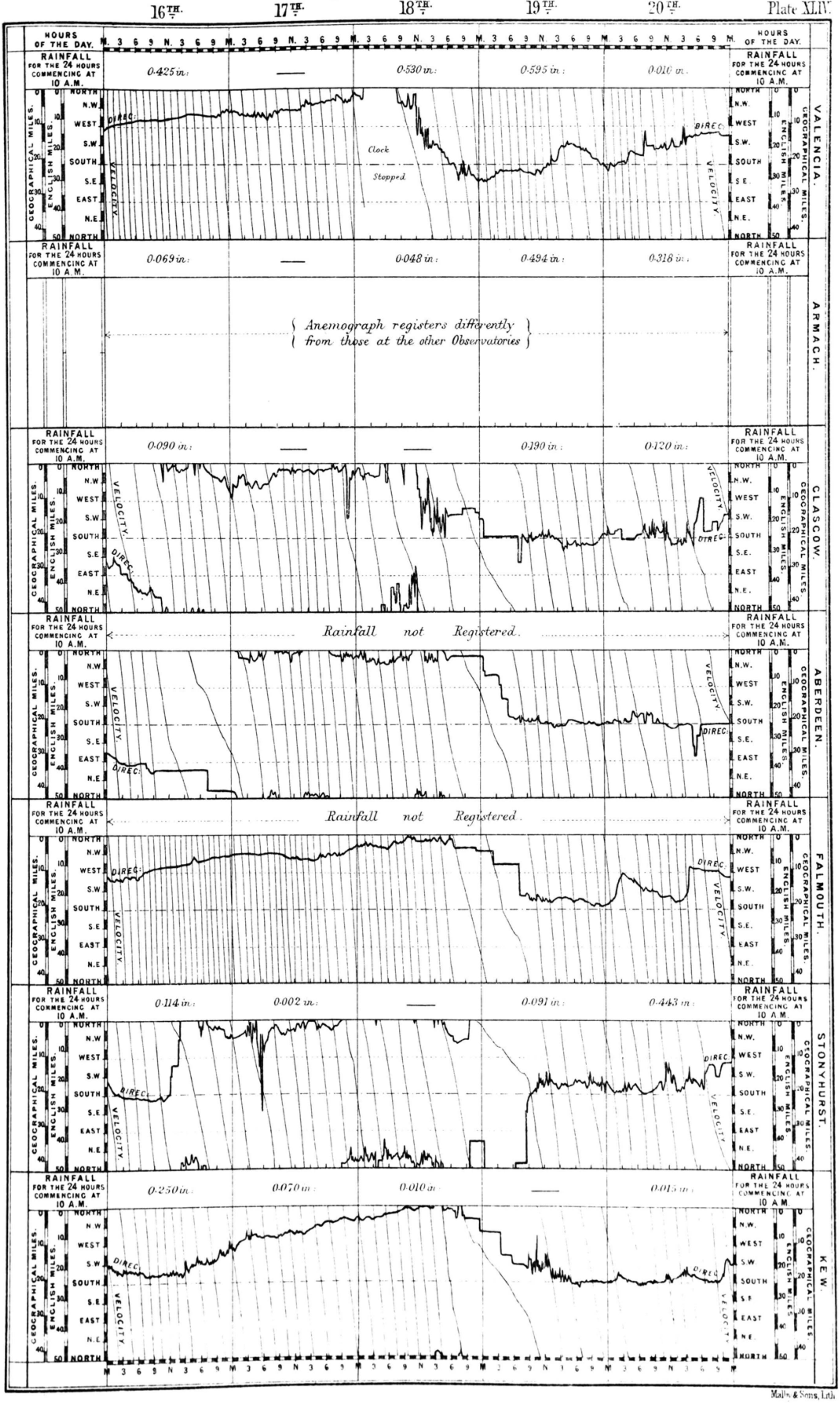


Malby & Sons, Lith.

APRIL, — 1869.

Plate XLIV.



Malby & Sons, Lith.

Plate XLV.

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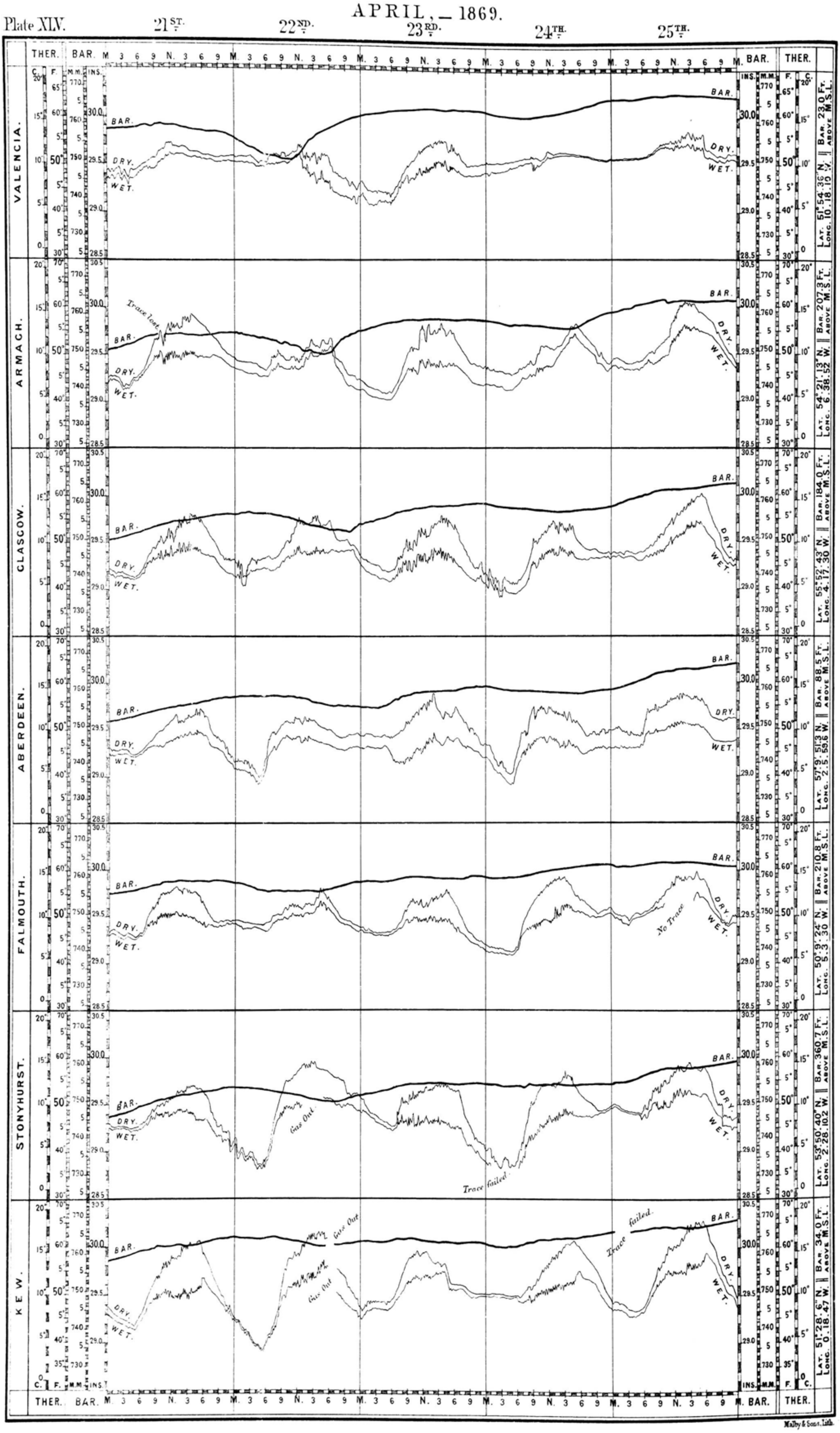
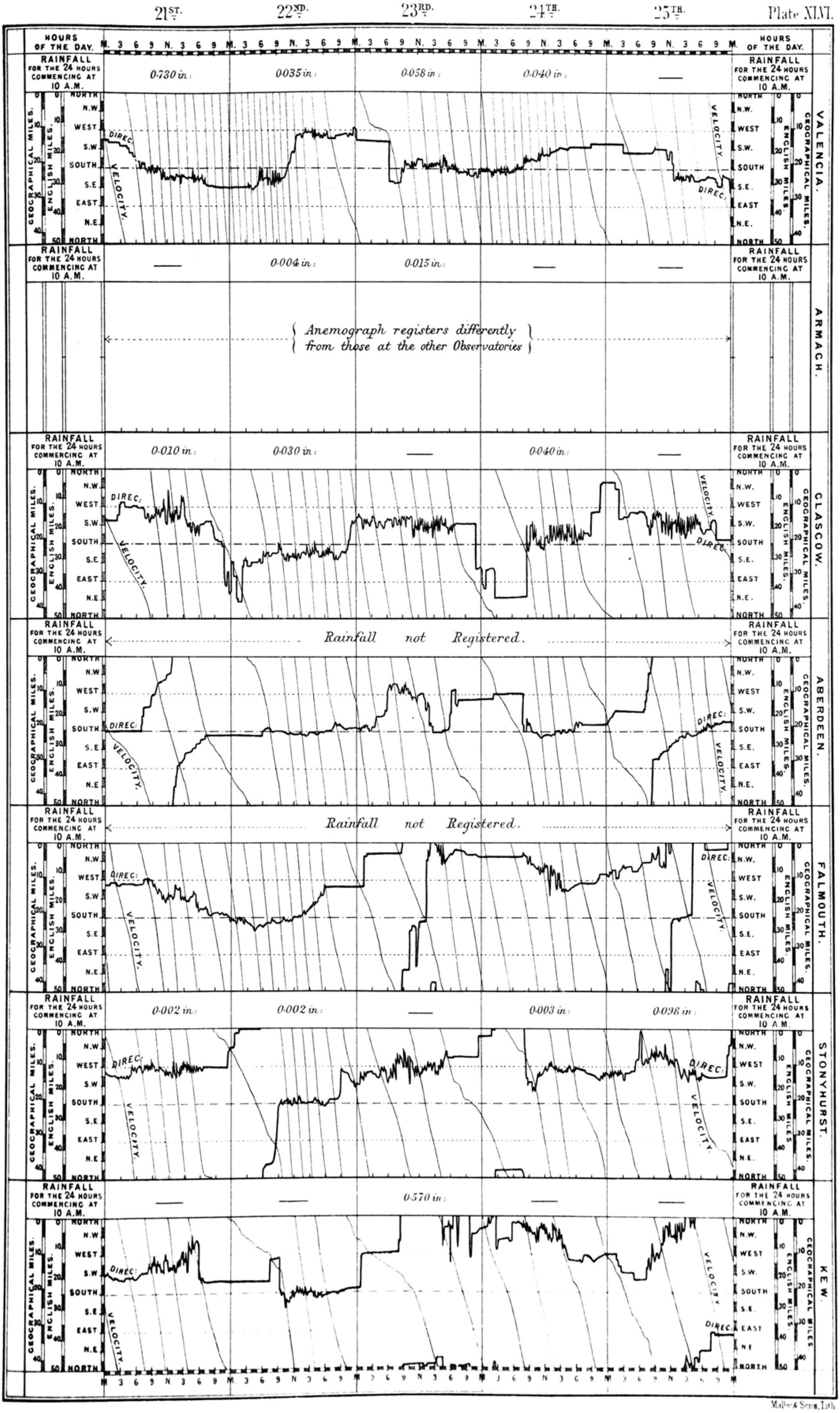


Maltby & Sons, Lith.

APRIL, — 1869.

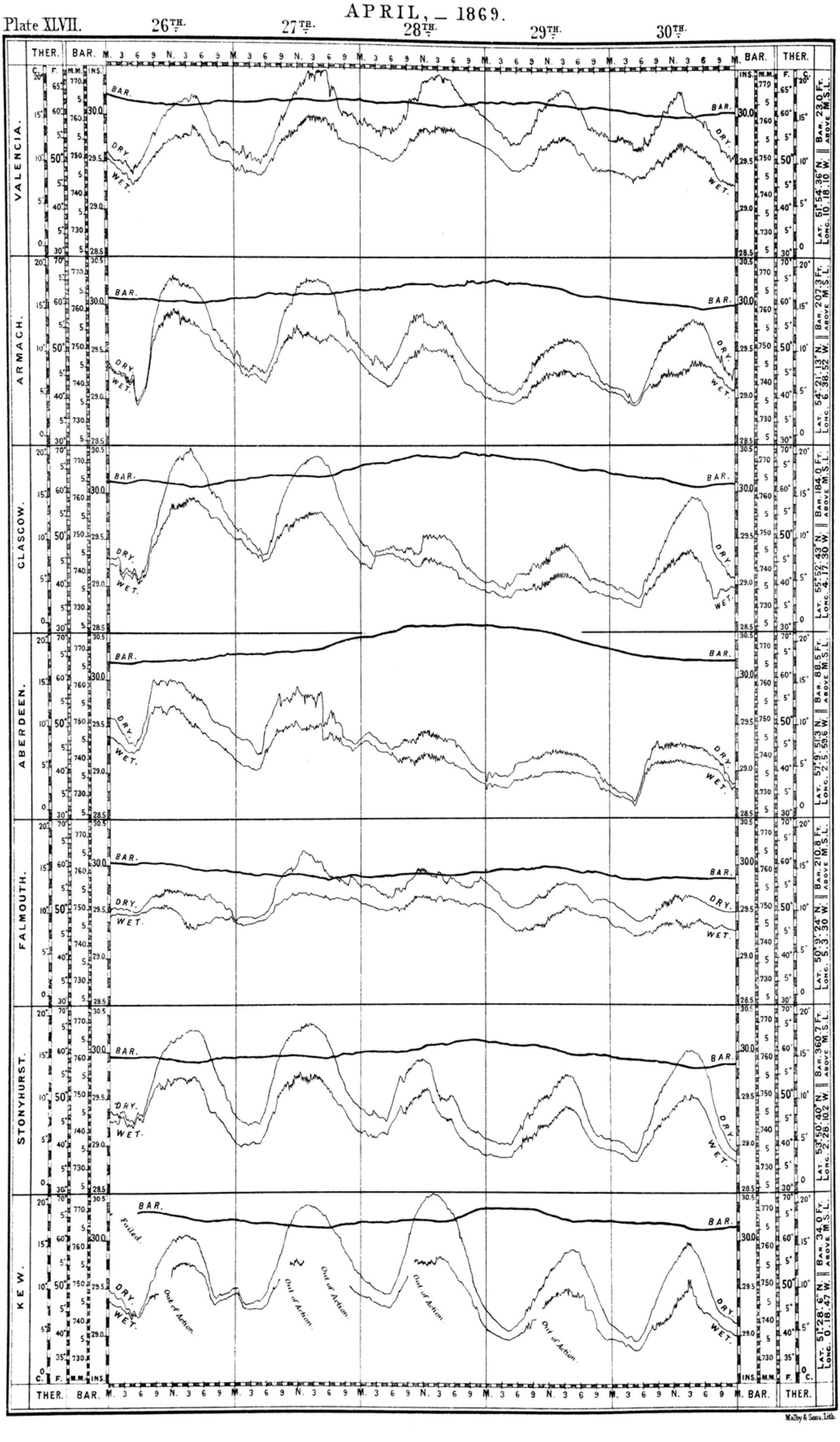
Plate XLVI.



Malby & Sons, Lith.

Plate XLVII.

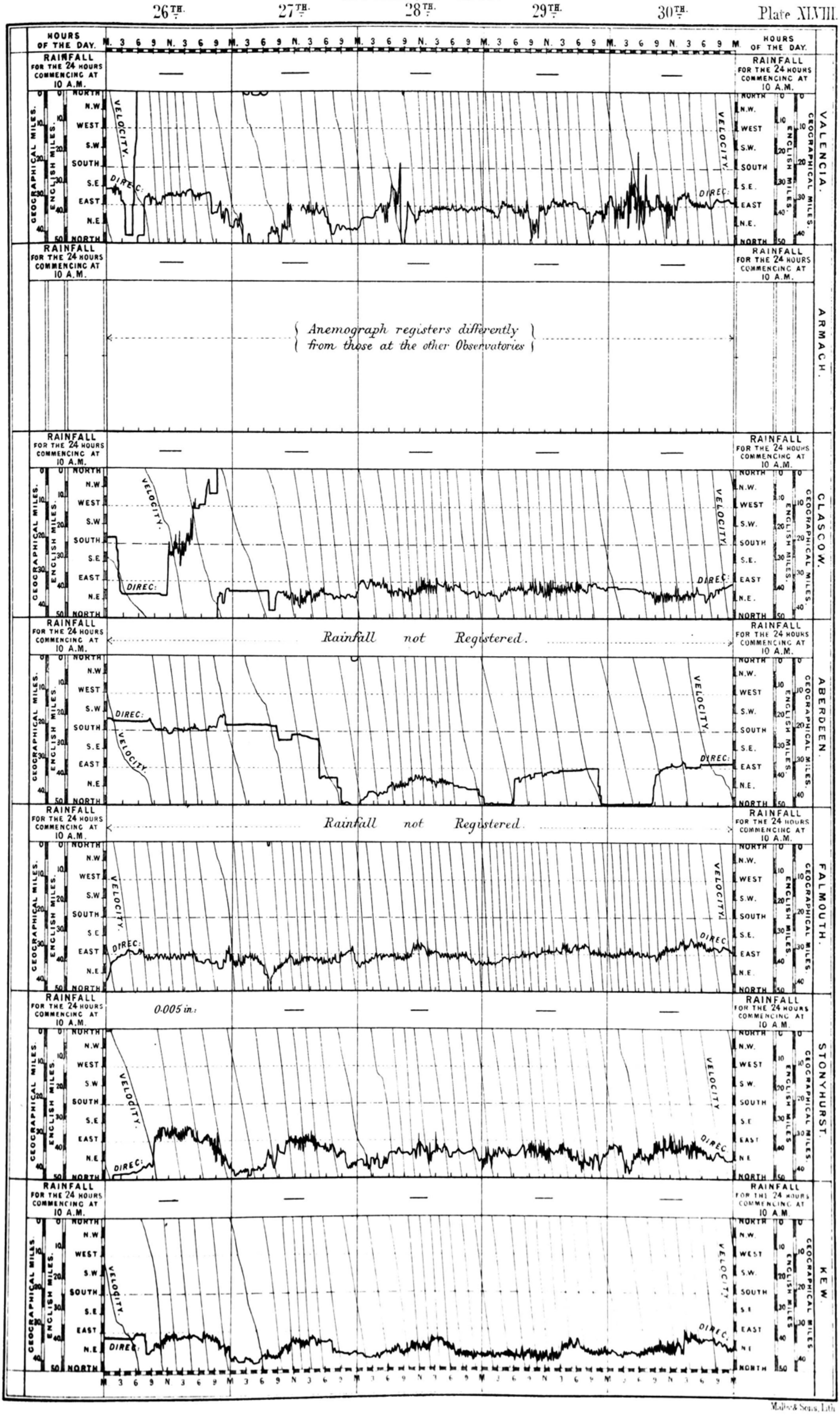
APRIL, _ 1869.



Malby & Sons, Lith.

APRIL, — 1869.

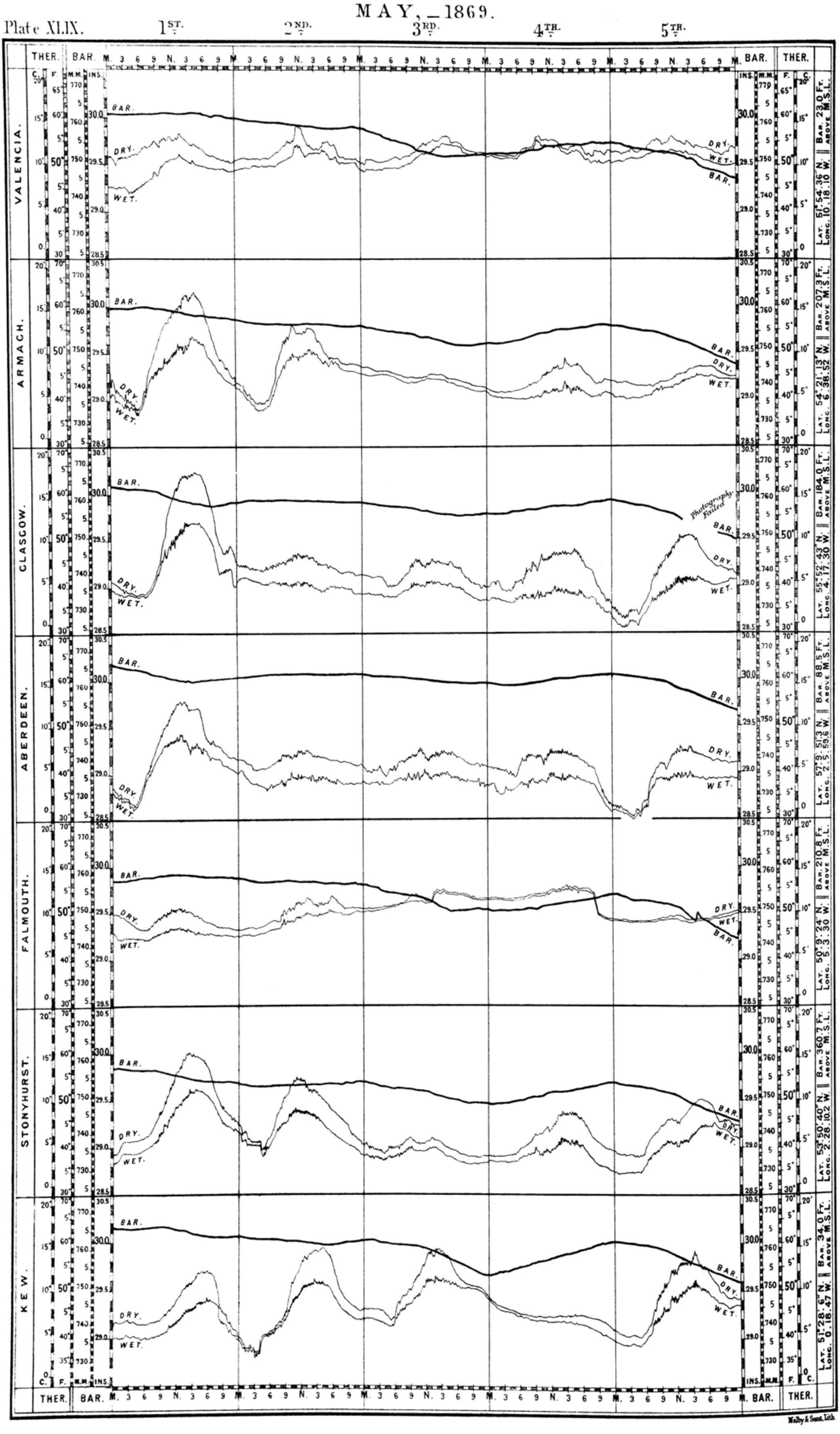
Plate XLVIII.



Malby & Sons, Lith.

MAY, —1869.

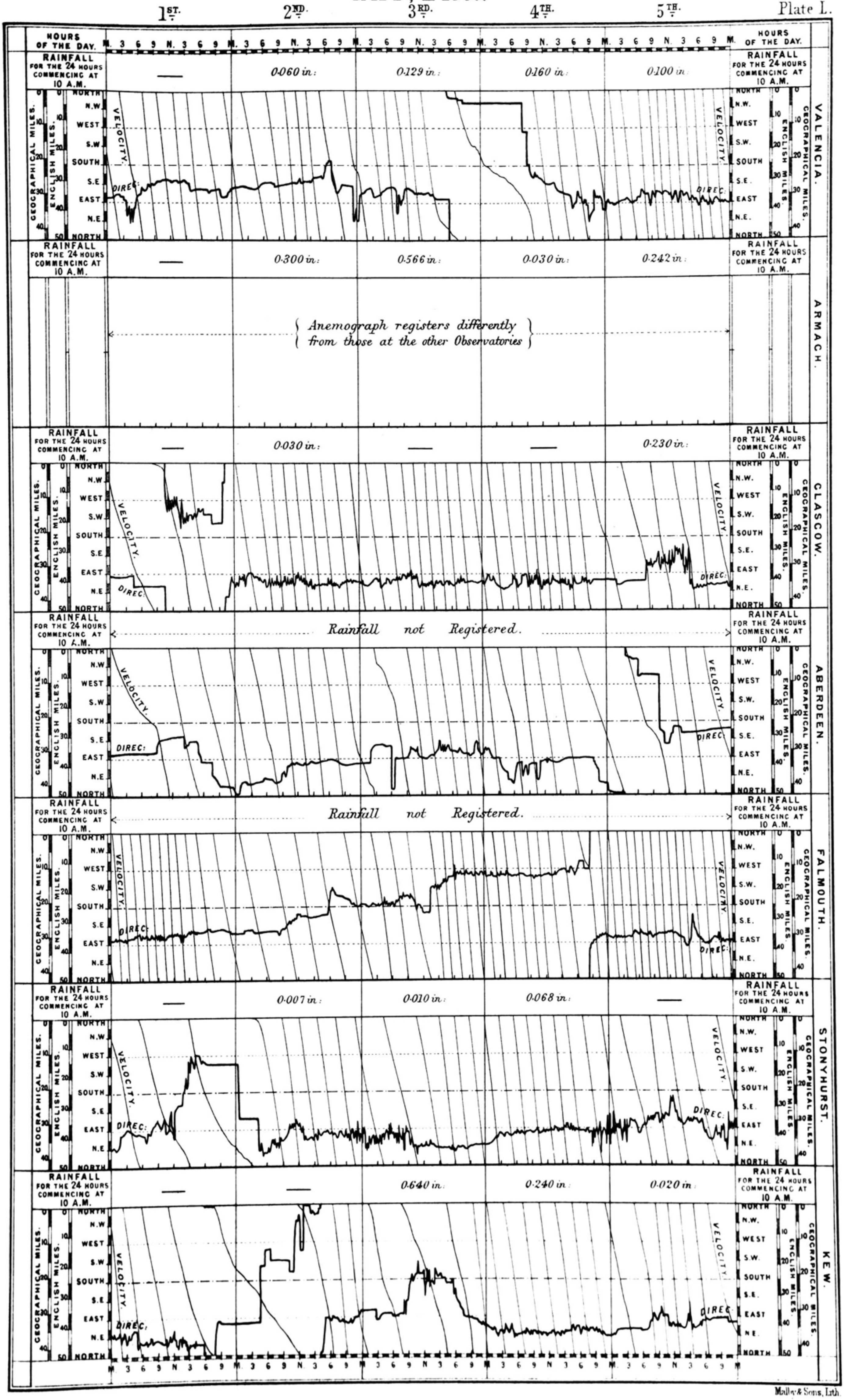
Plate XLIX.



Malby & Sons, Lith.

MAY, — 1869.

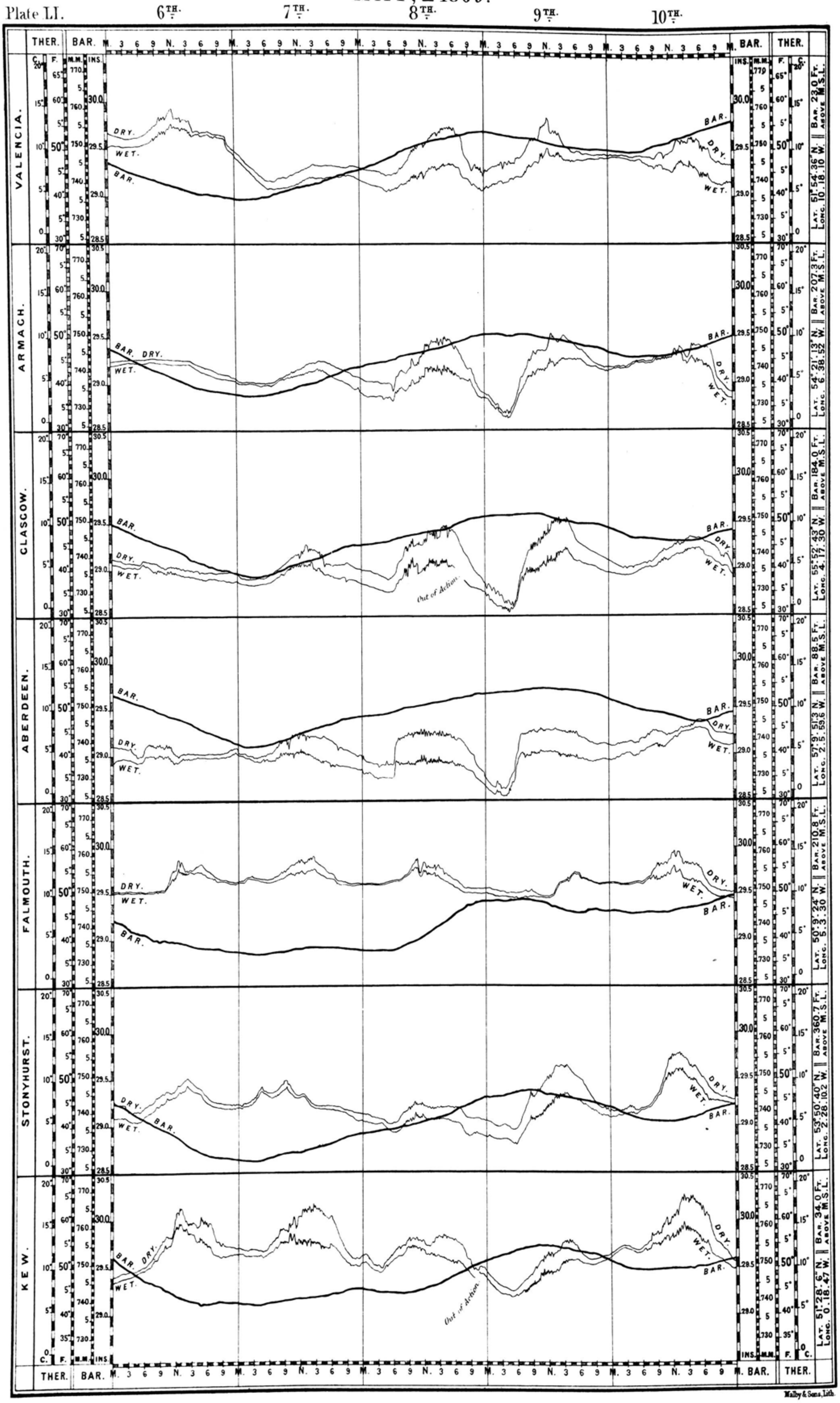
Plate L.



Malby & Sons, Lith.

Plate LI.

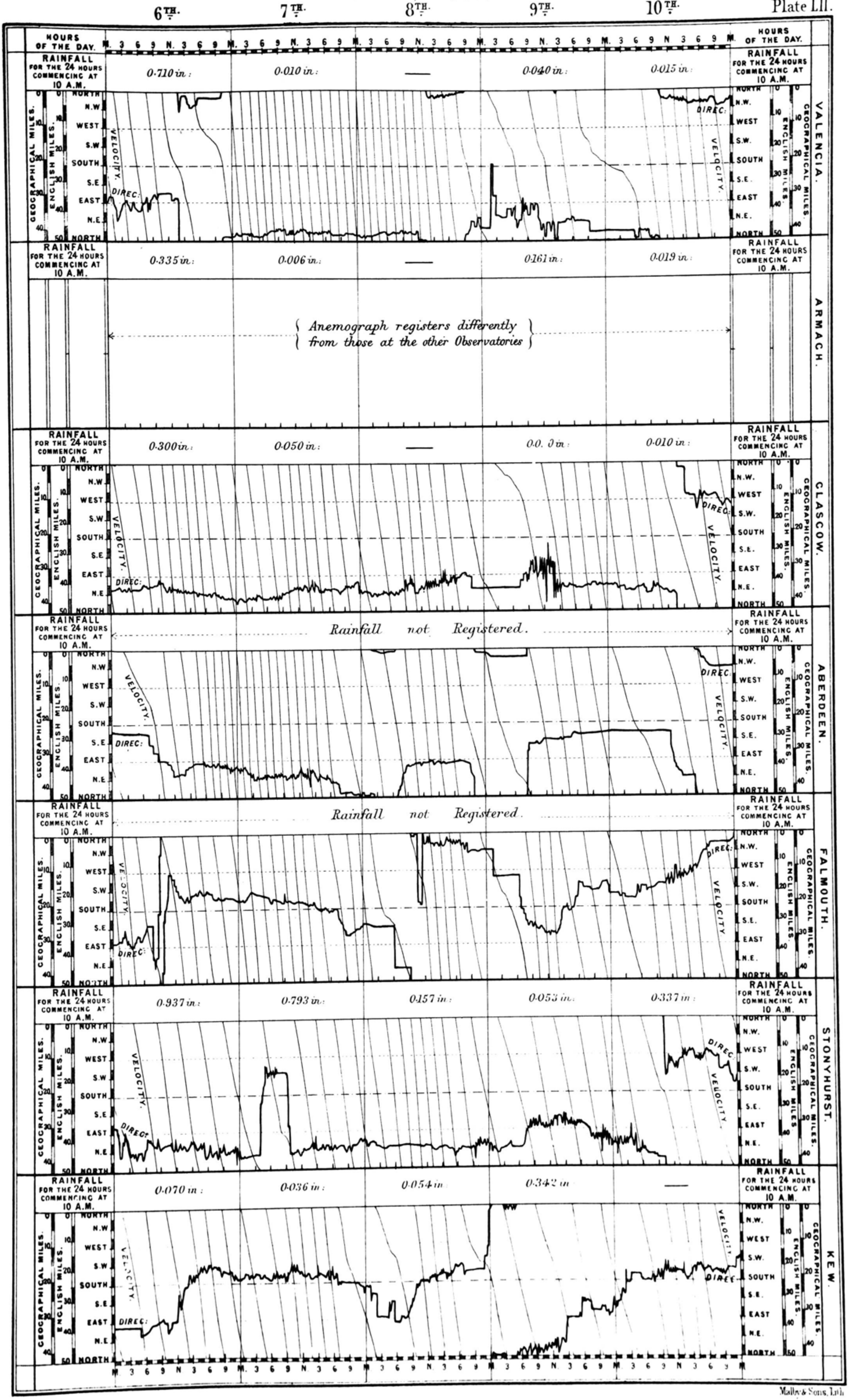
MAY, _1869.



Malby & Sons, Lith.

MAY, — 1869.

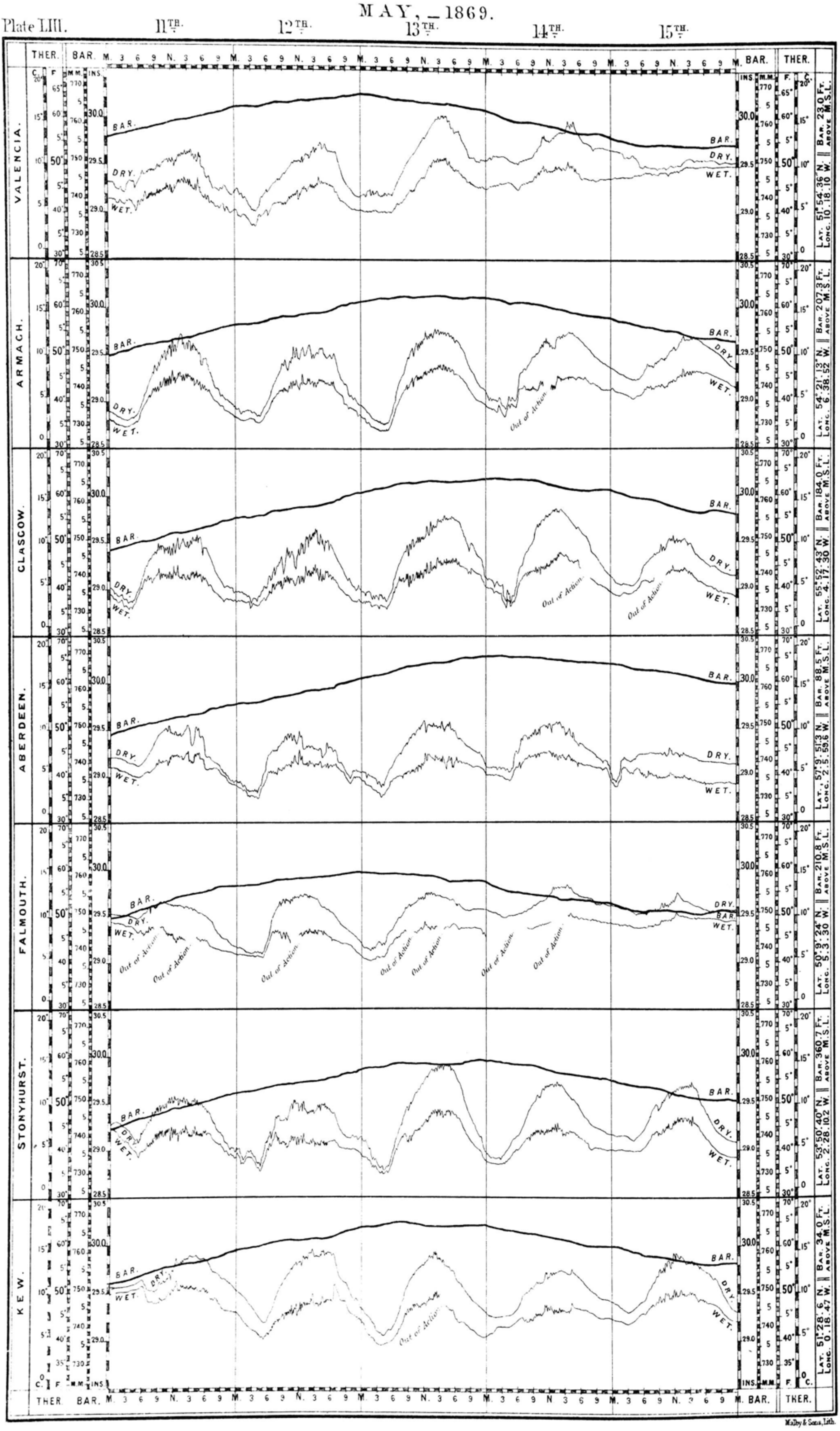
Plate LII.



Malby & Sons, Lith.

Plate LIII.

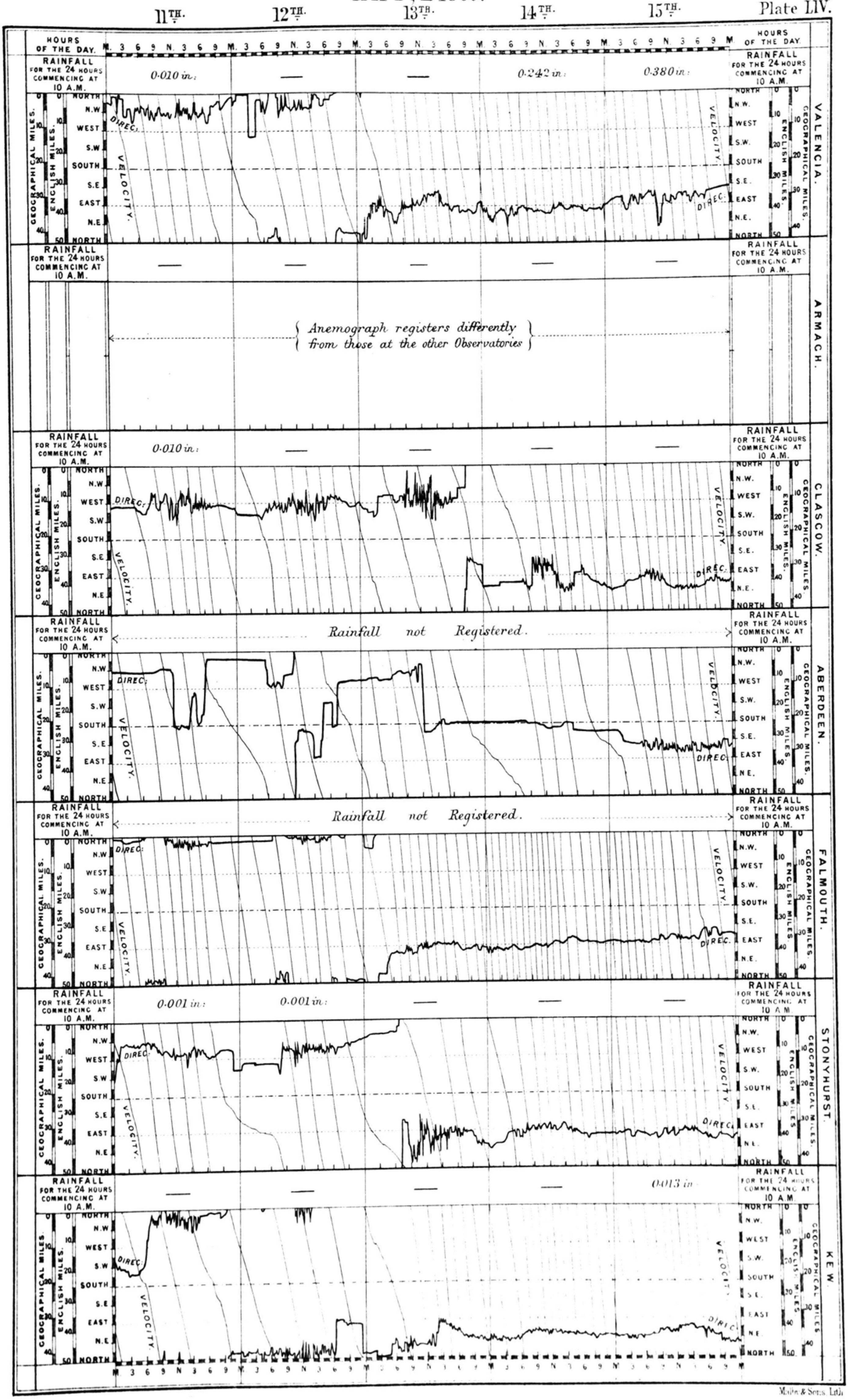
MAY, _1869.



Malby & Sons, Lith.

MAY, _ 1869.

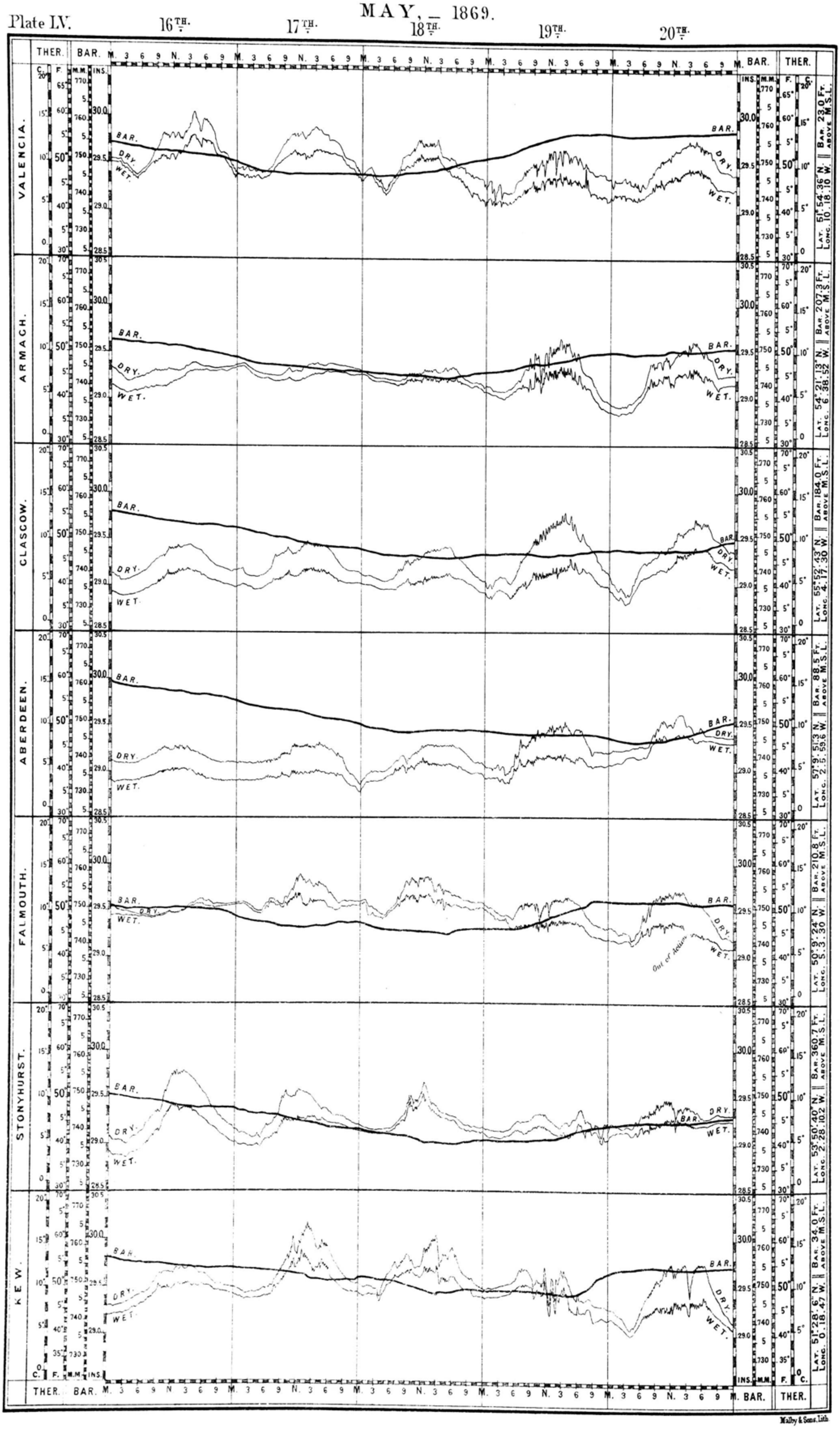
Plate LIV.



Malby & Sons, Lith.

Plate LV.

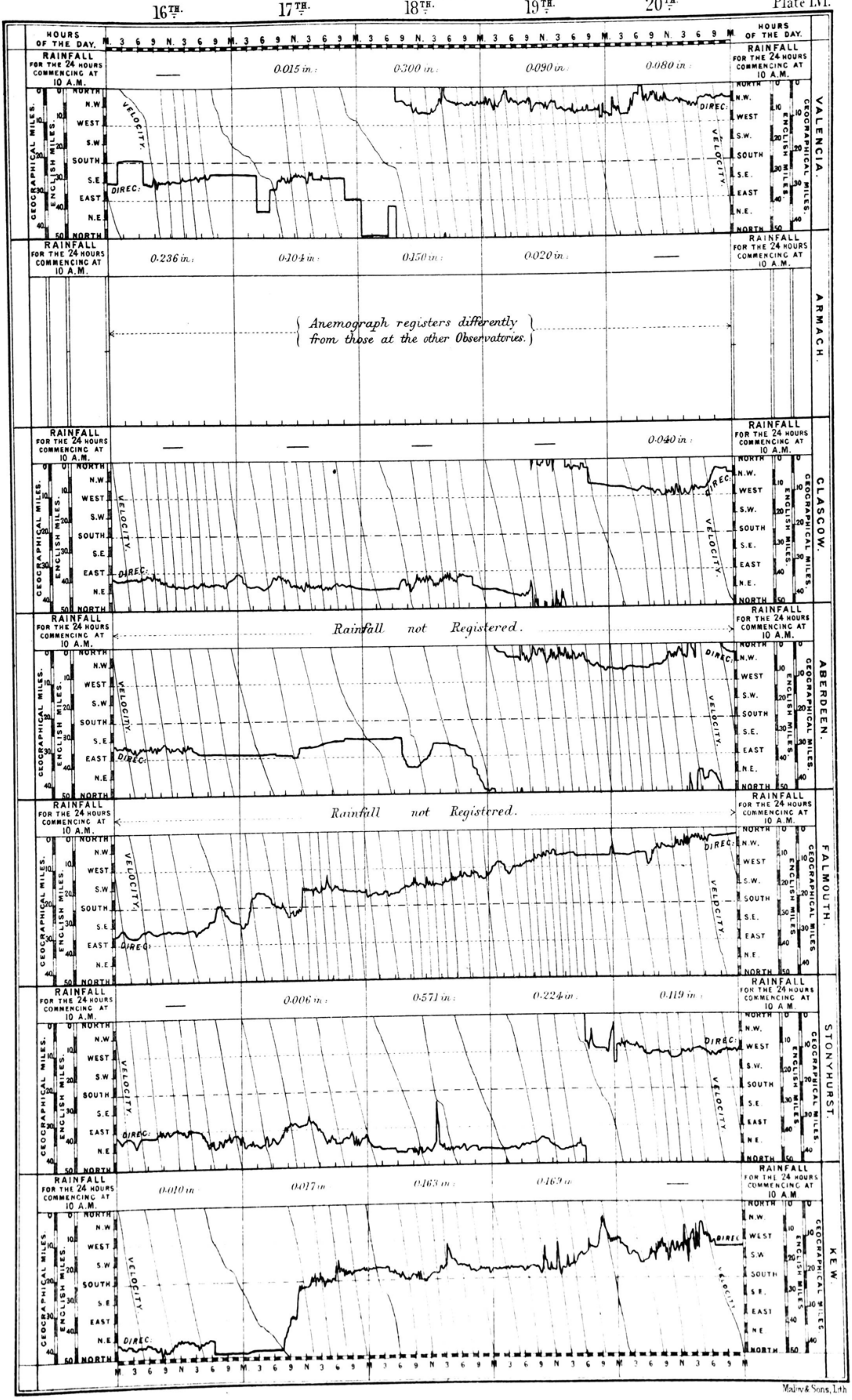
MAY, — 1869.



Malby & Sons, Lith.

MAY, — 1869.

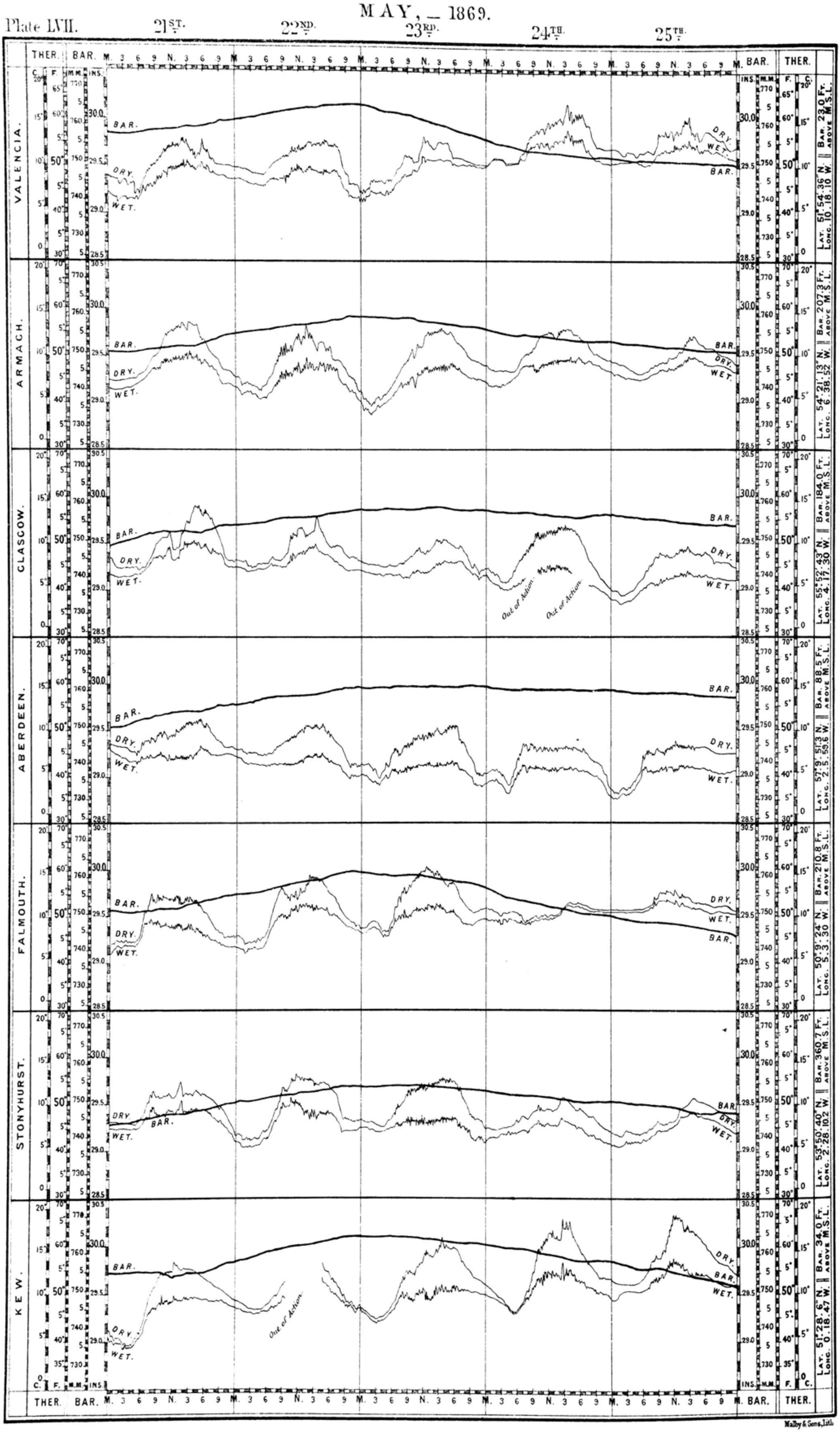
Plate LVI.



Malby & Sons, Lith

Plate LVII.

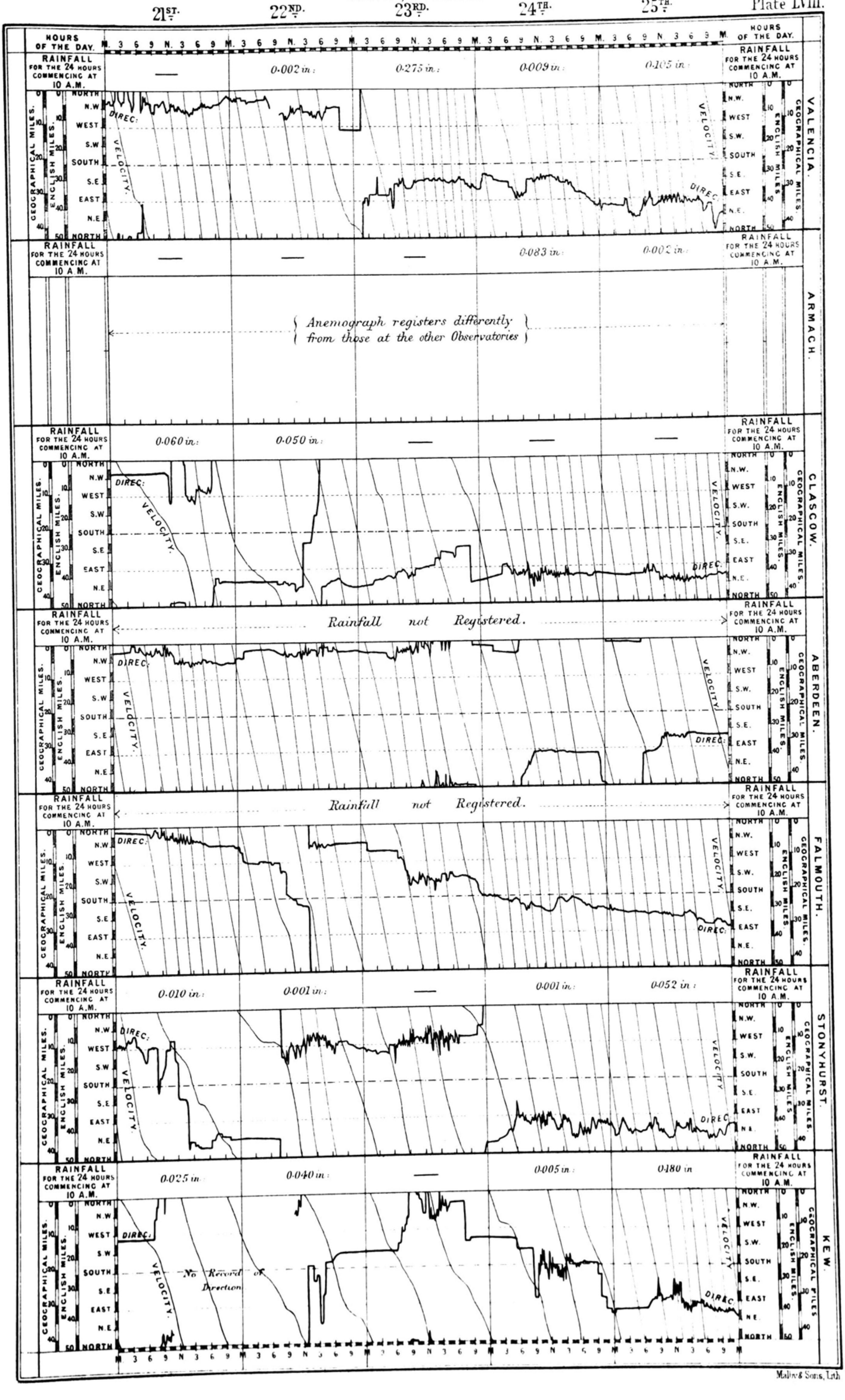
MAY, — 1869.



Malby & Sons, Lith.

MAY, _ 1869.

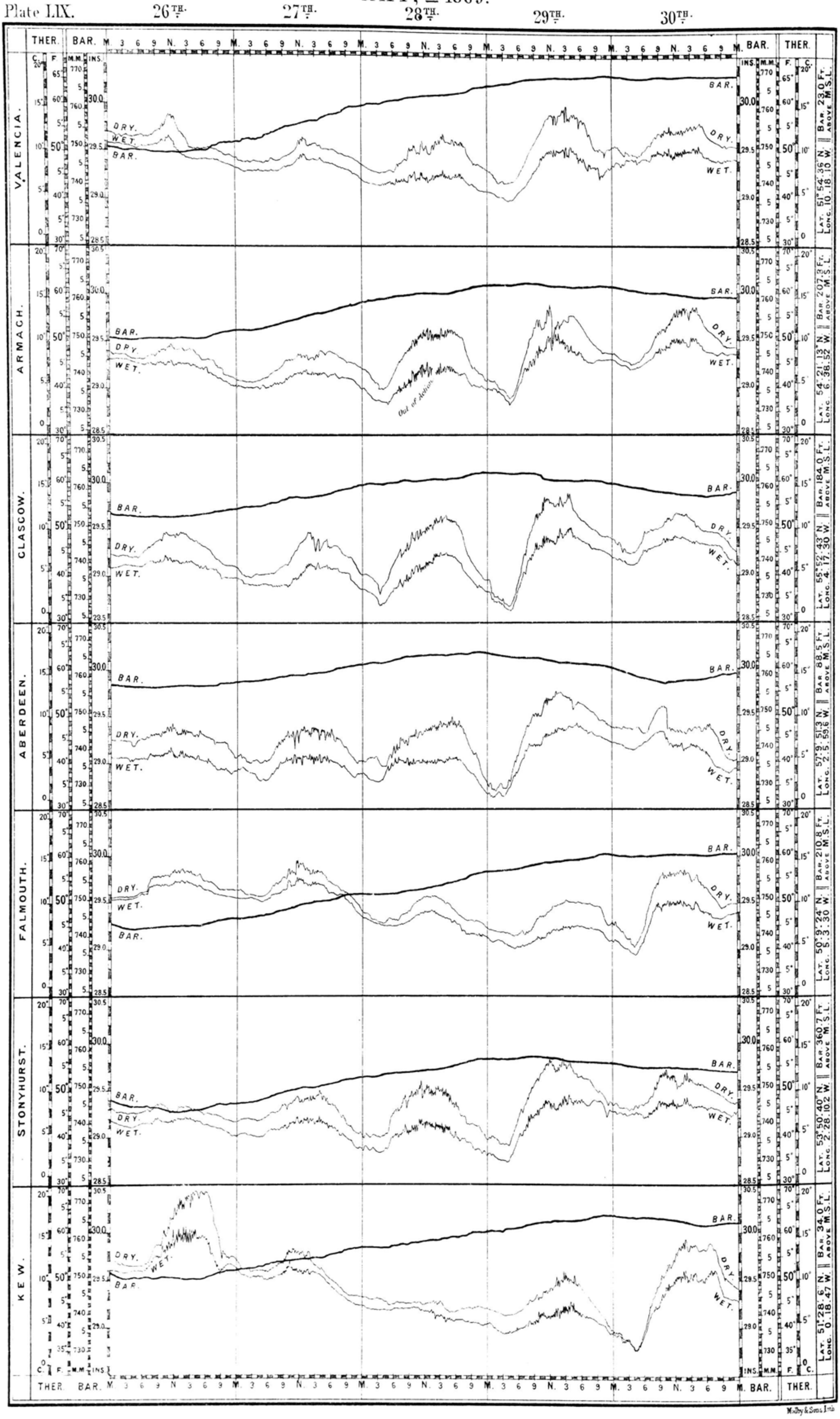
Plate LVIII.



Malby & Sons, Lith.

Plate LIX.

MAY, — 1869.



Malby & Sons Lith.

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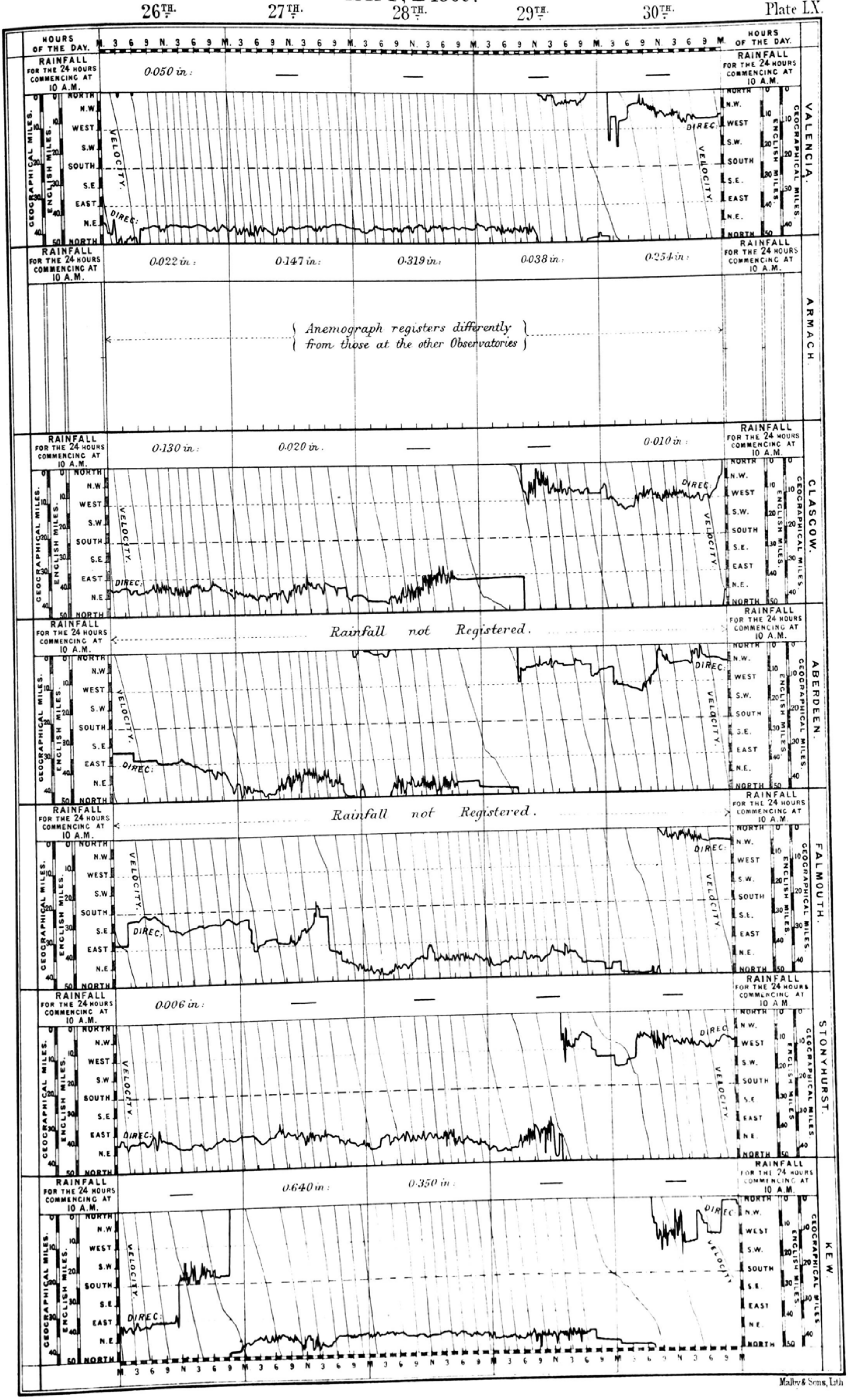
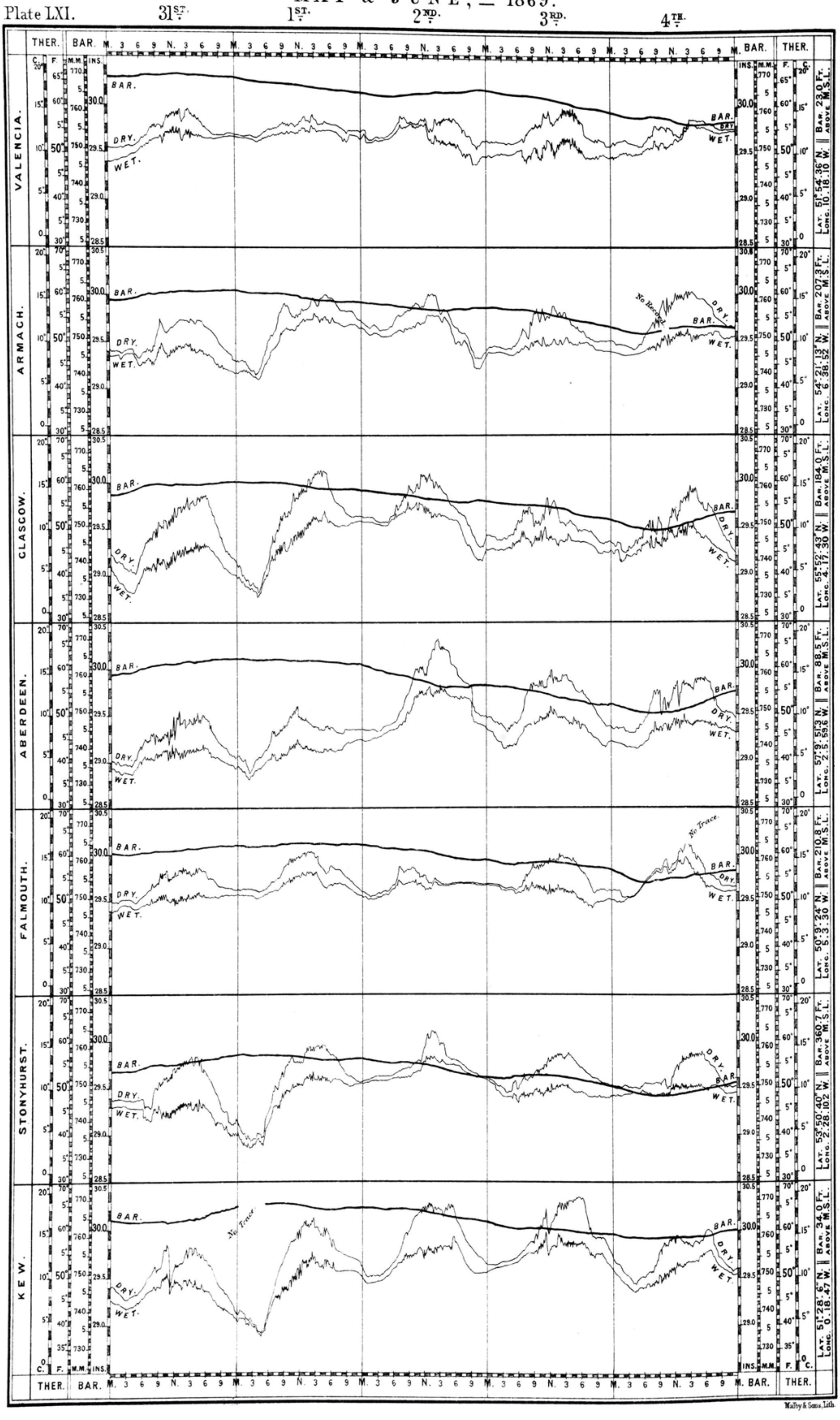


Malby & Sons, Lith.

MAY & JUNE, — 1869.

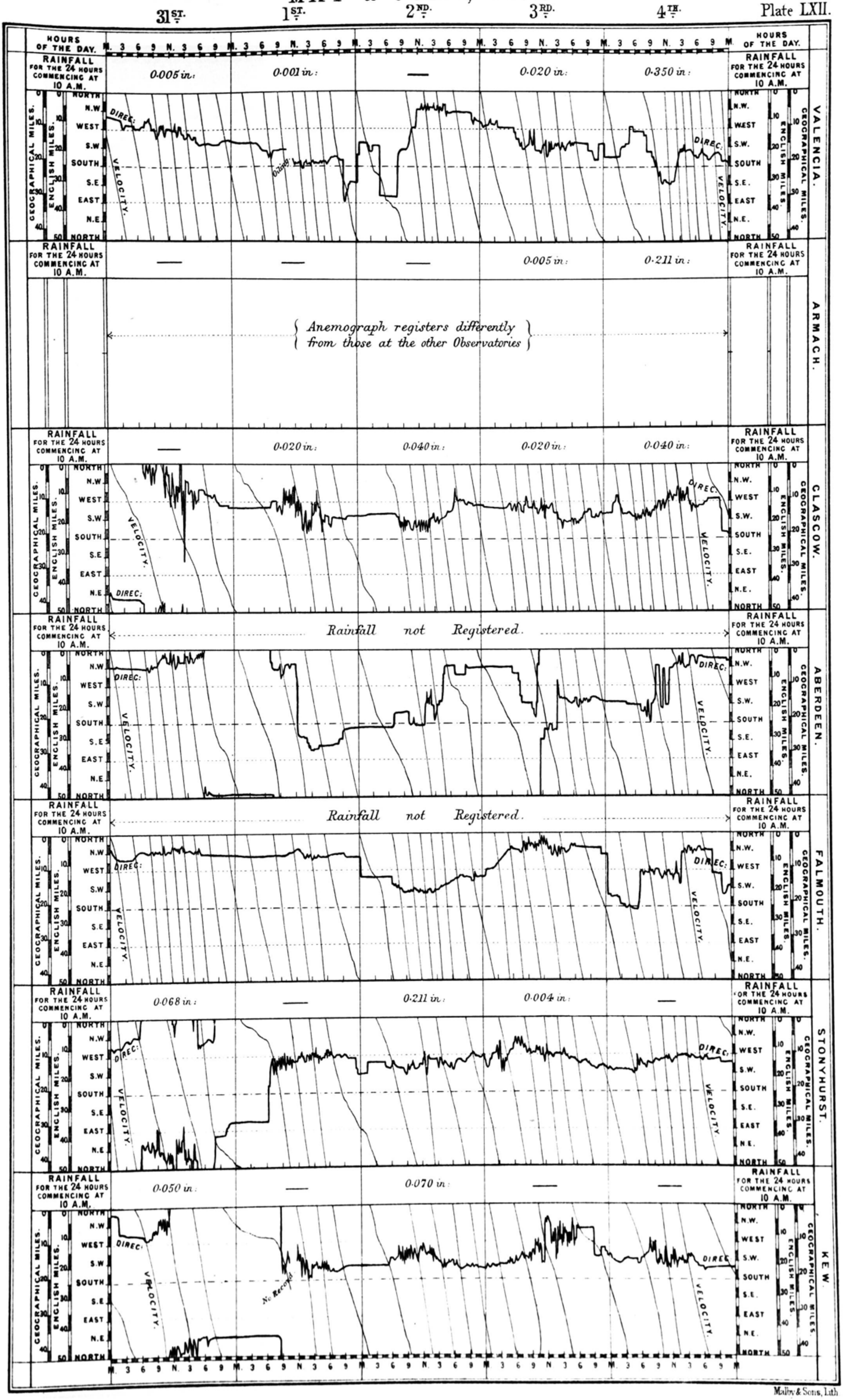
Plate LXI.



Malby & Sons, Lith.

MAY & JUNE, —1869.

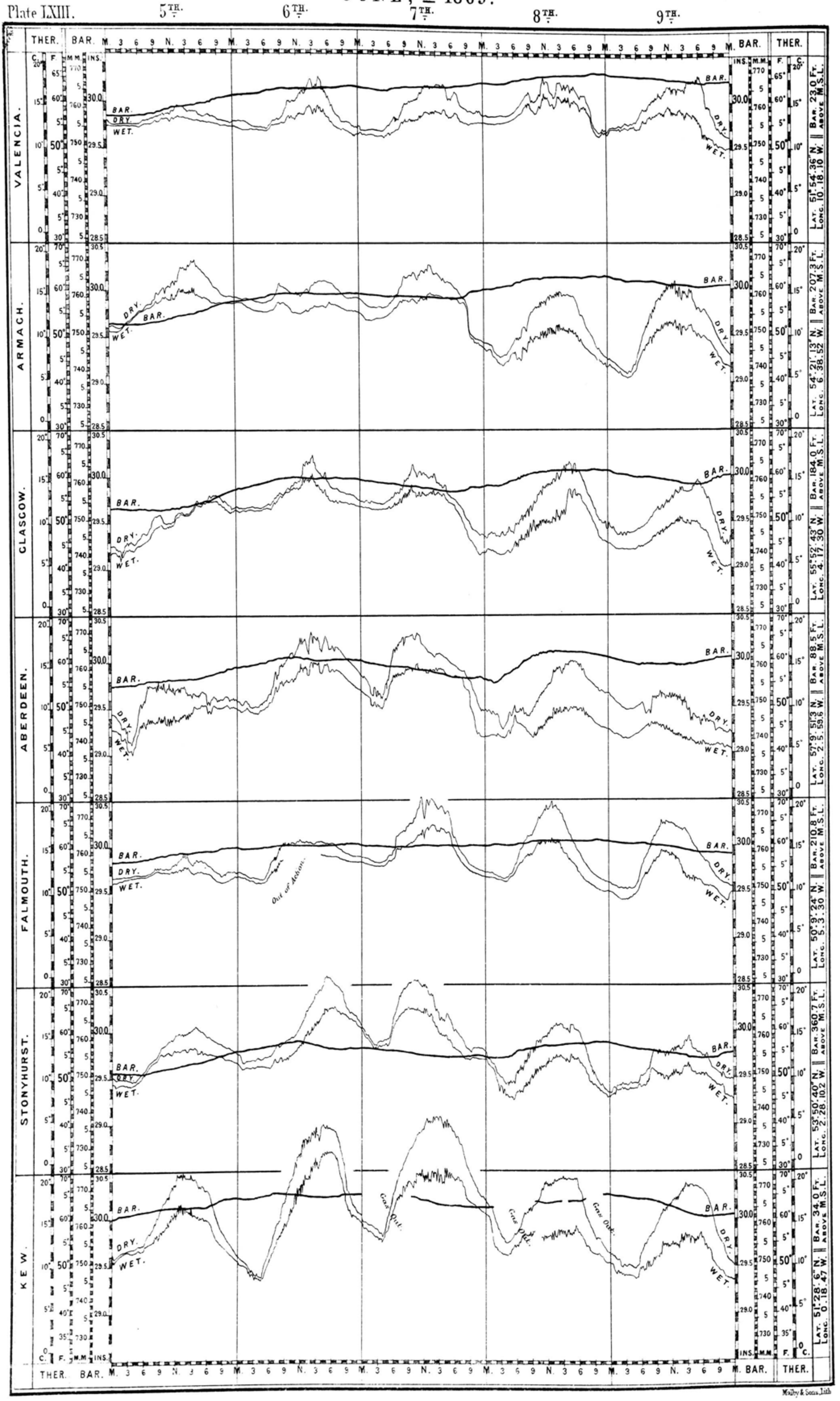
Plate LXII.



Malby & Sons, Lith

Plate LXIII.

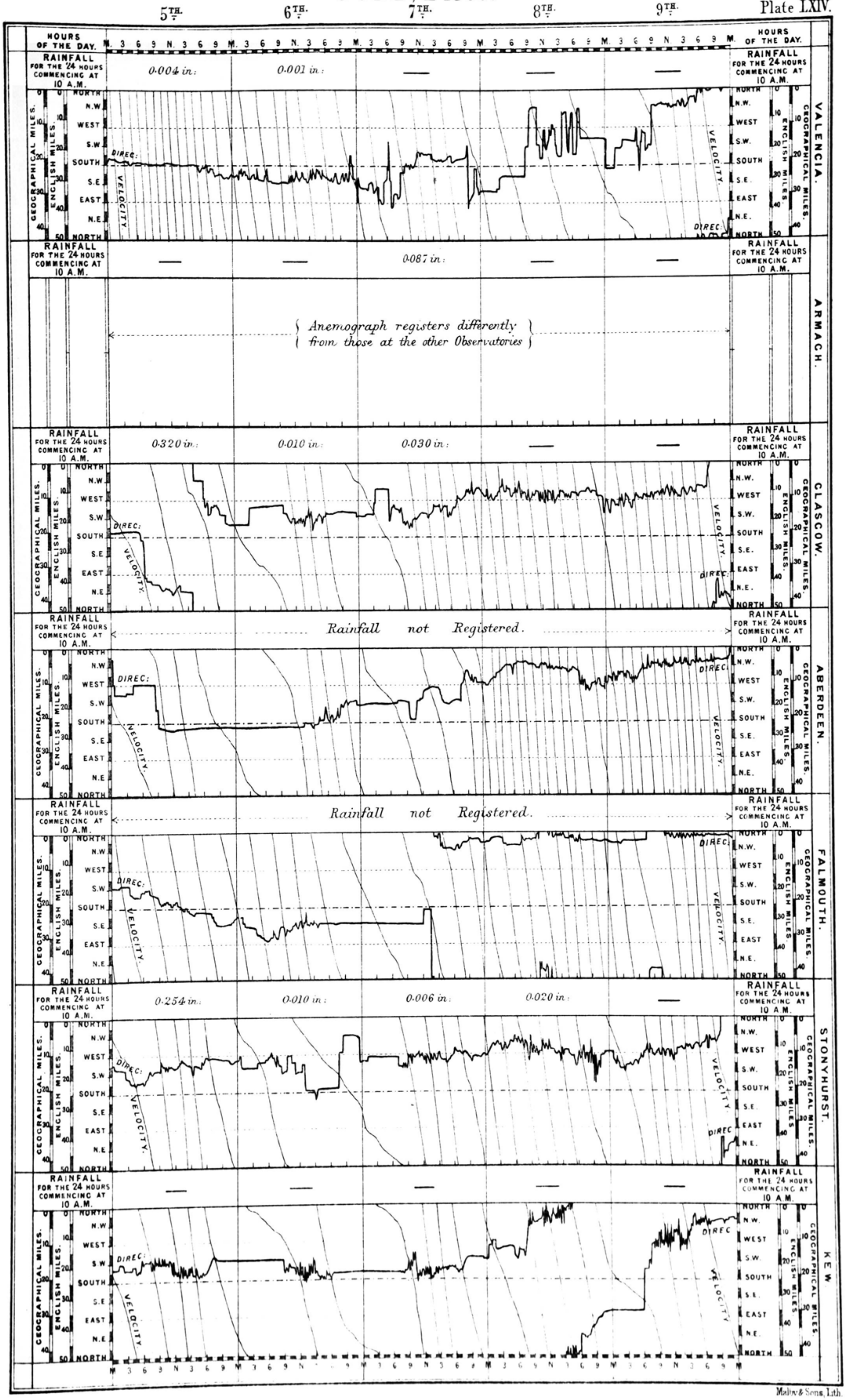
JUNE, — 1869.



Maltby & Sons, Lith.

JUNE, — 1869.

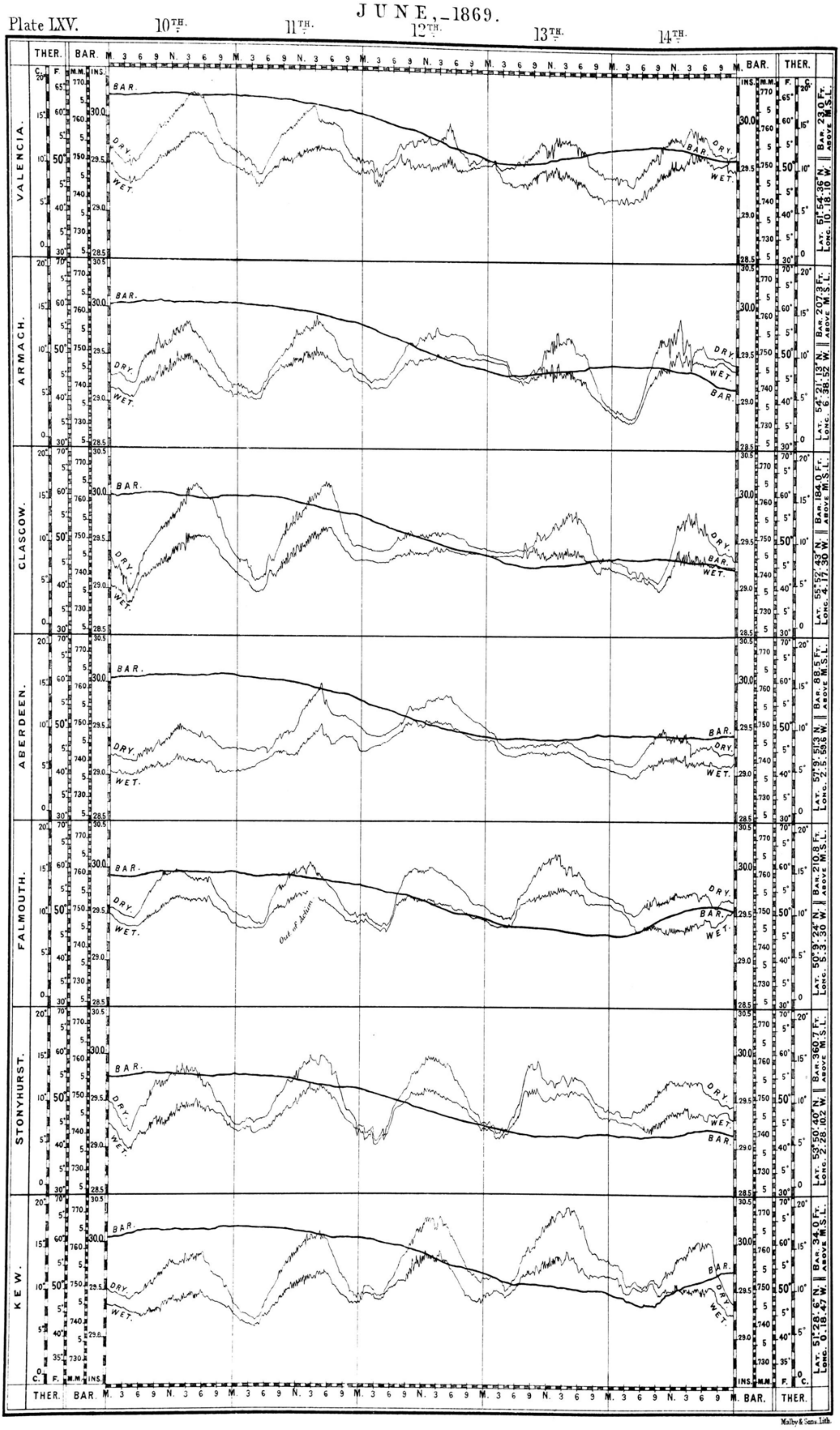
Plate LXIV.



Malby & Sons, Lith.

Plate LXV.

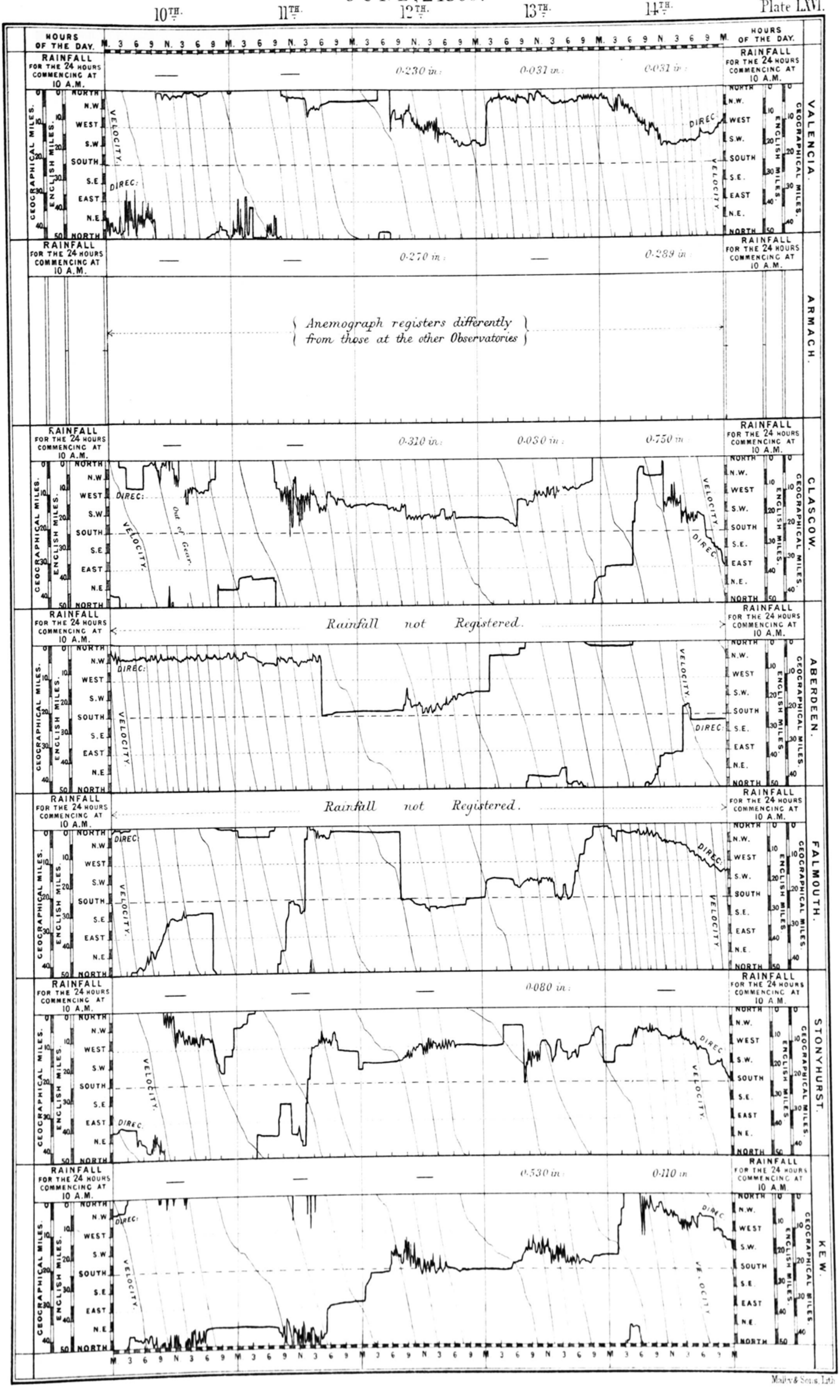
JUNE, -1869.



Malby & Sons. Lith.

JUNE, _1869.

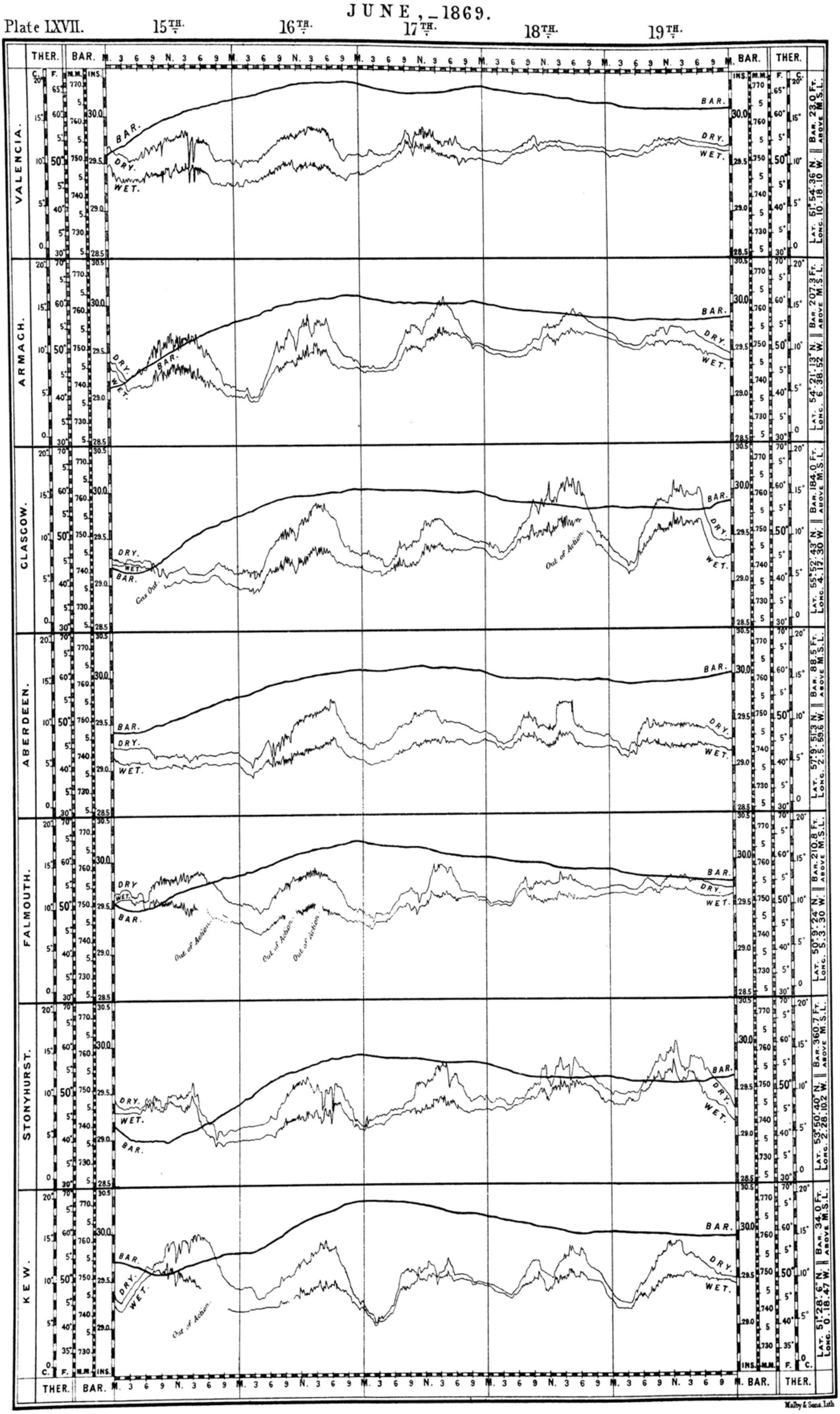
Plate LXVI.



Malby & Sons, Lith.

Plate LXVII.

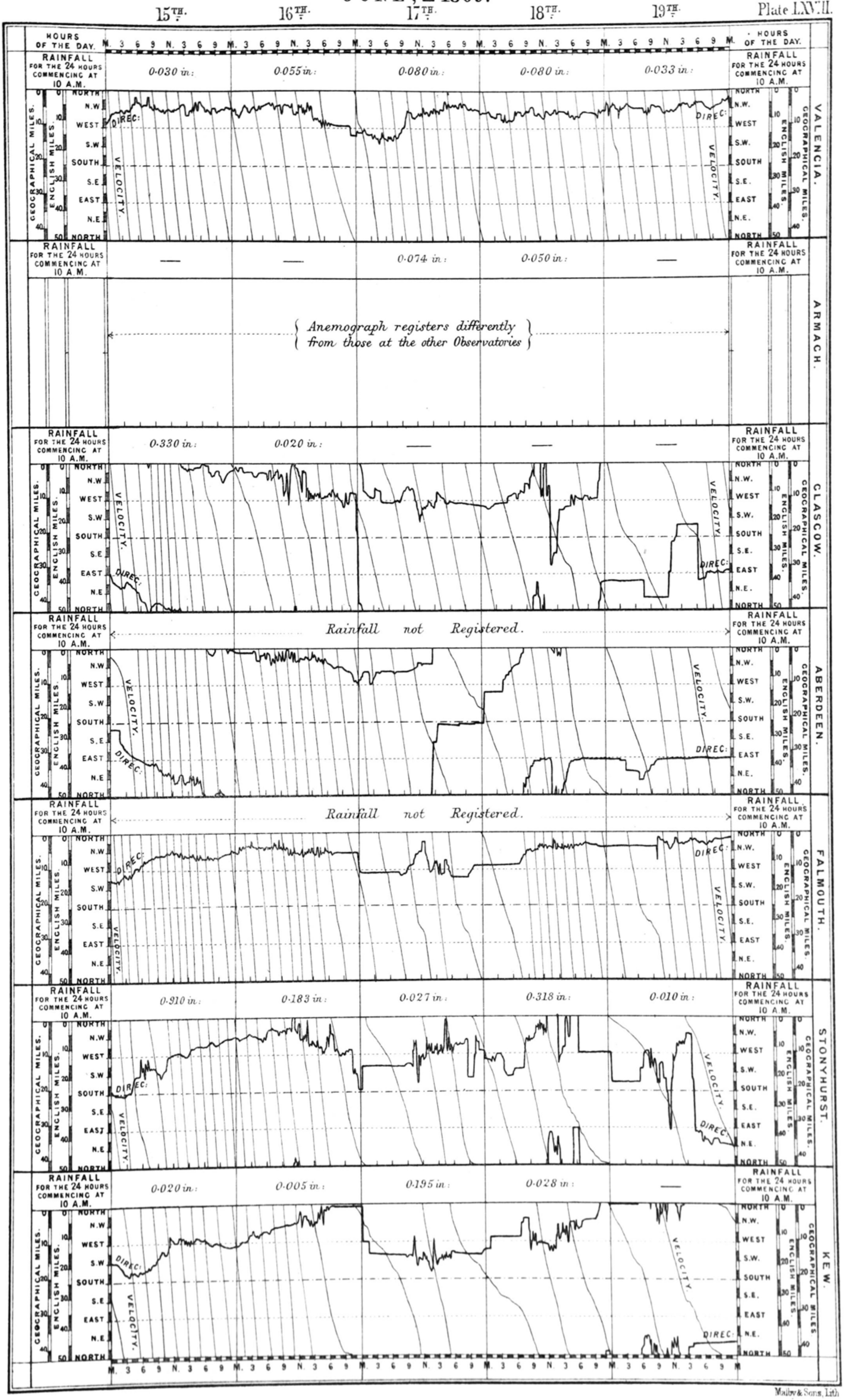
JUNE, _1869.



Malby & Sons. Lith.

JUNE, — 1869.

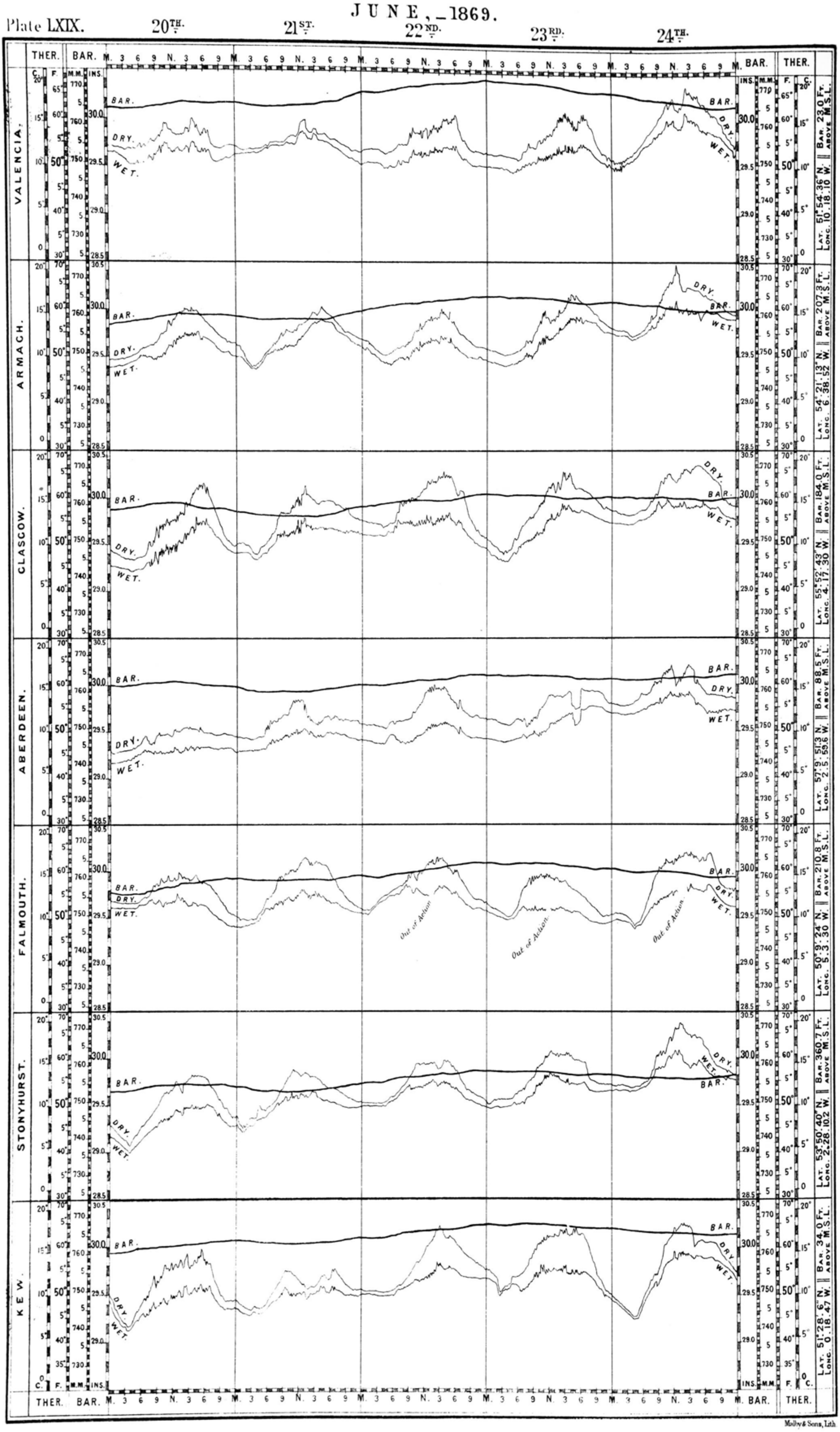
Plate LXVII.



Malby & Sons, Lith.

Plate LXIX.

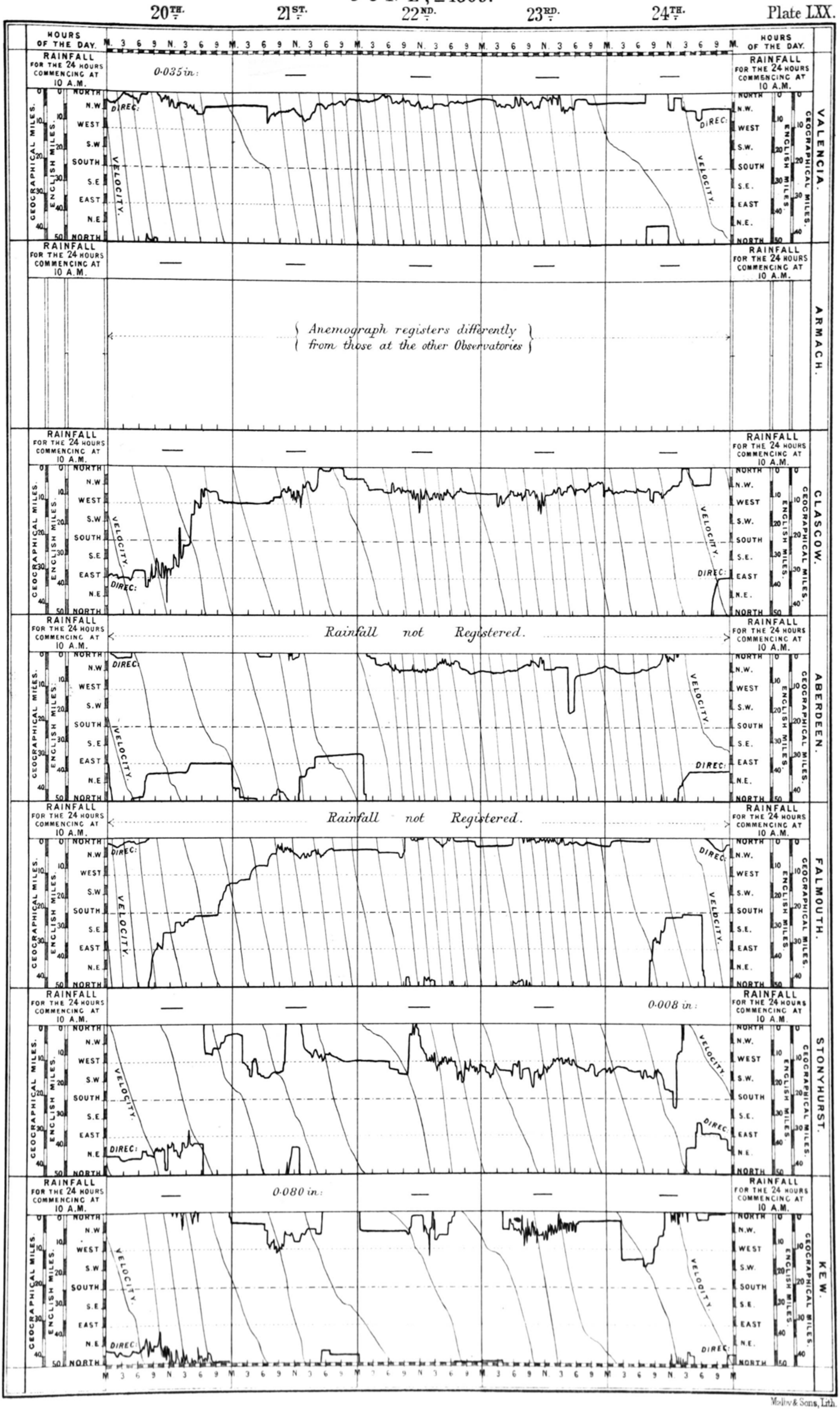
JUNE, _1869.



Malby & Sons, Lith.

JUNE, — 1869.

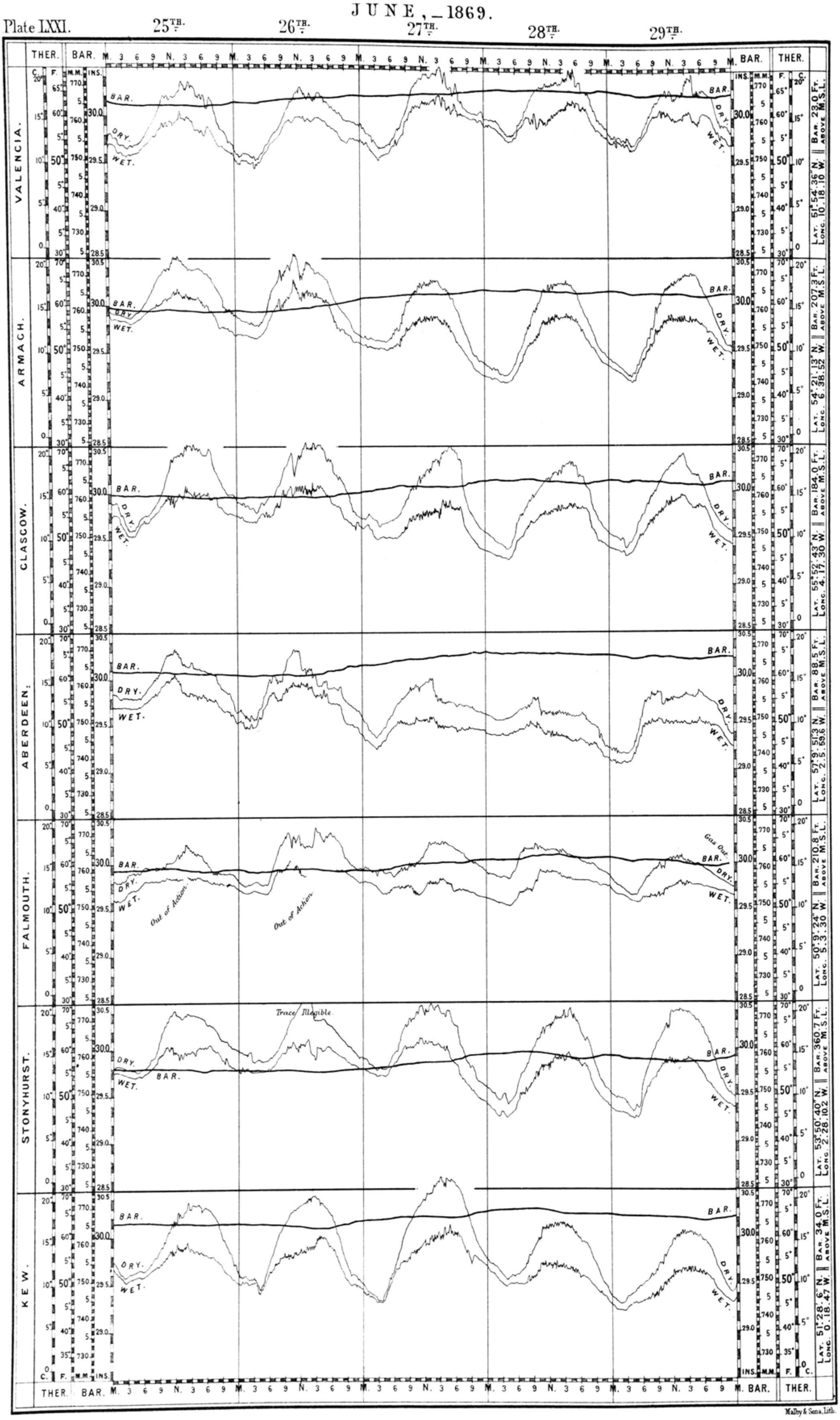
Plate LXX.



Malby & Sons, Lith.

Plate LXXI.

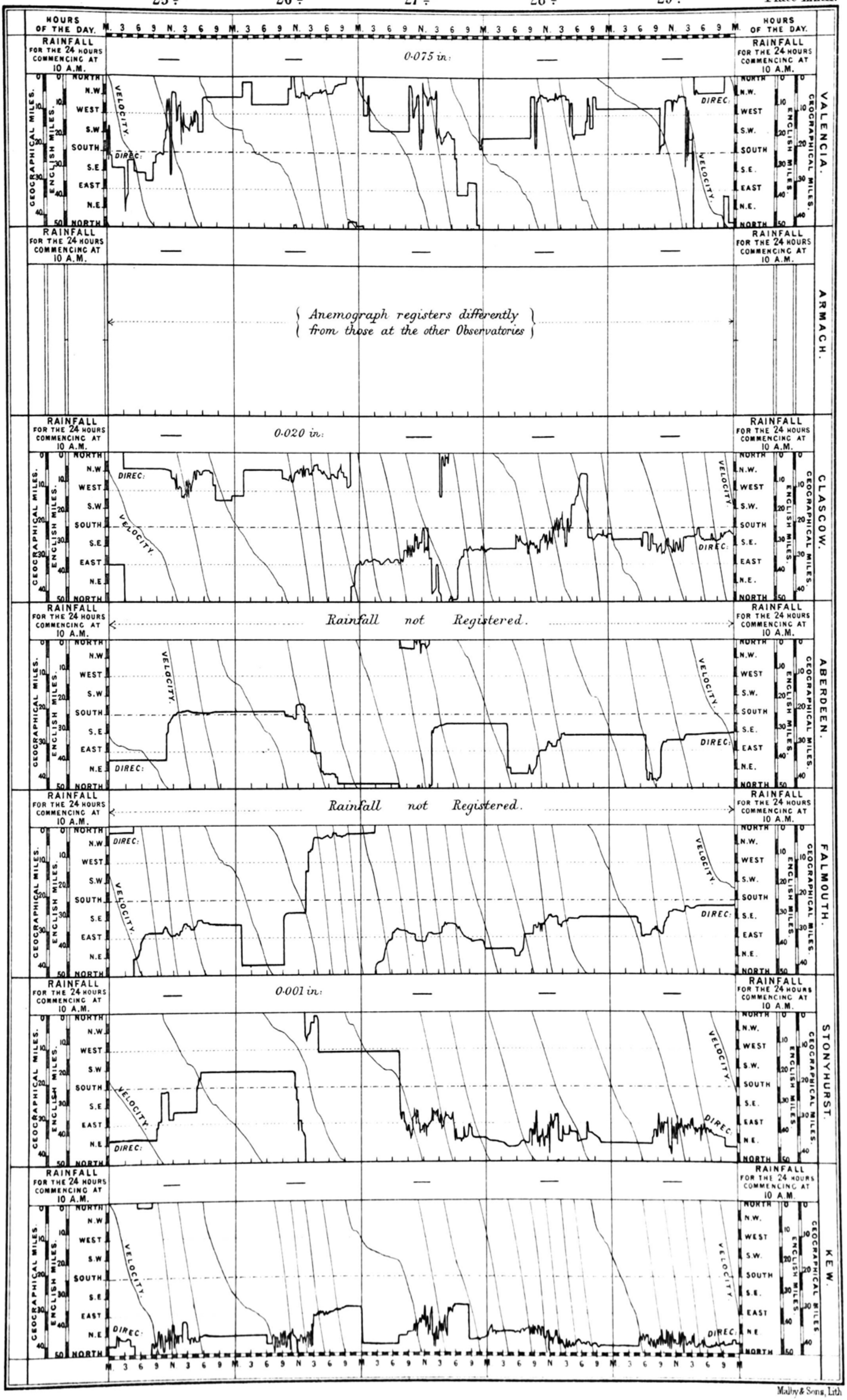
JUNE, —1869.



Malby & Sons, Lith.

JUNE, _1869.

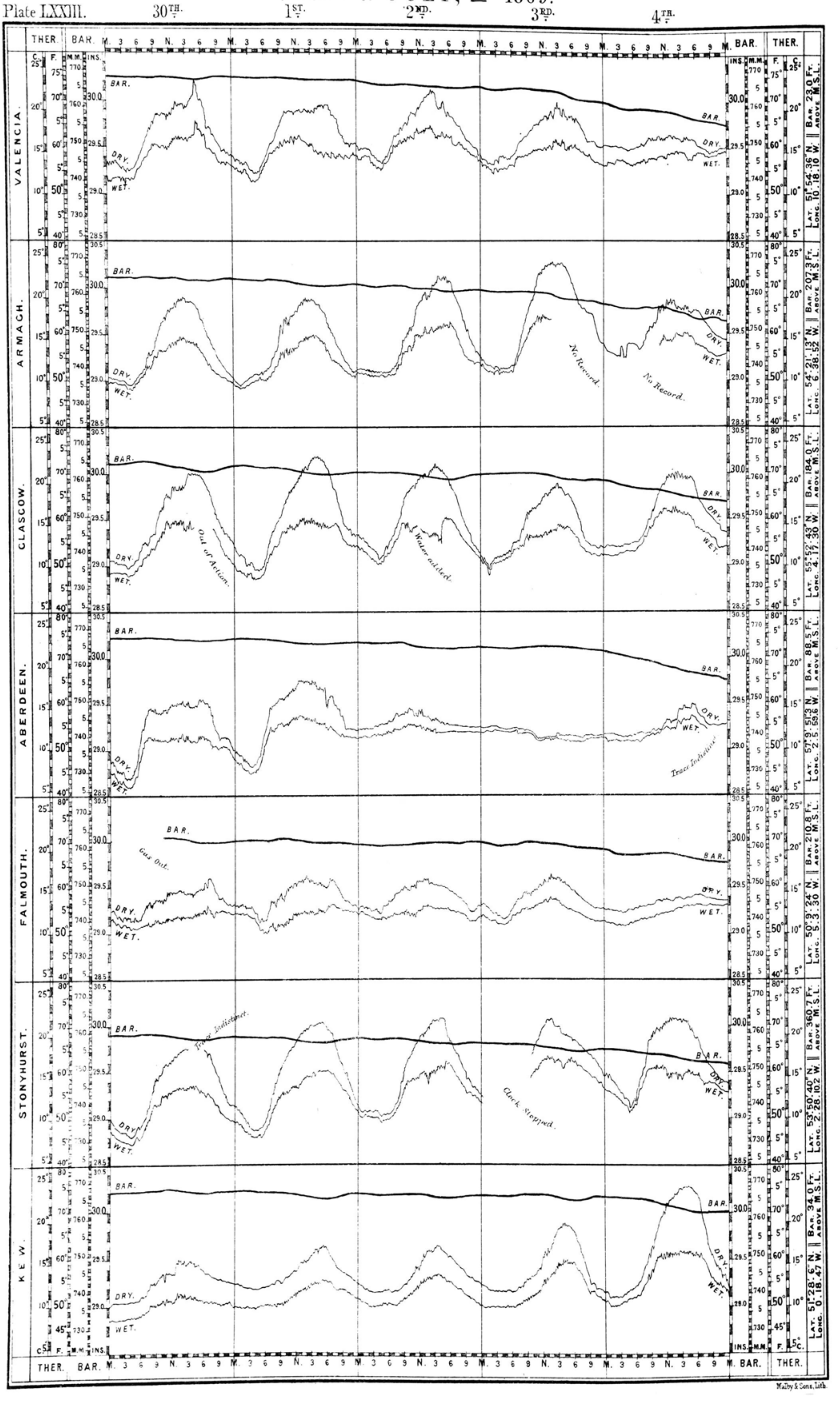
25th. 26th. 27th. 28th. 29th.



Maltby & Sons, Lith.

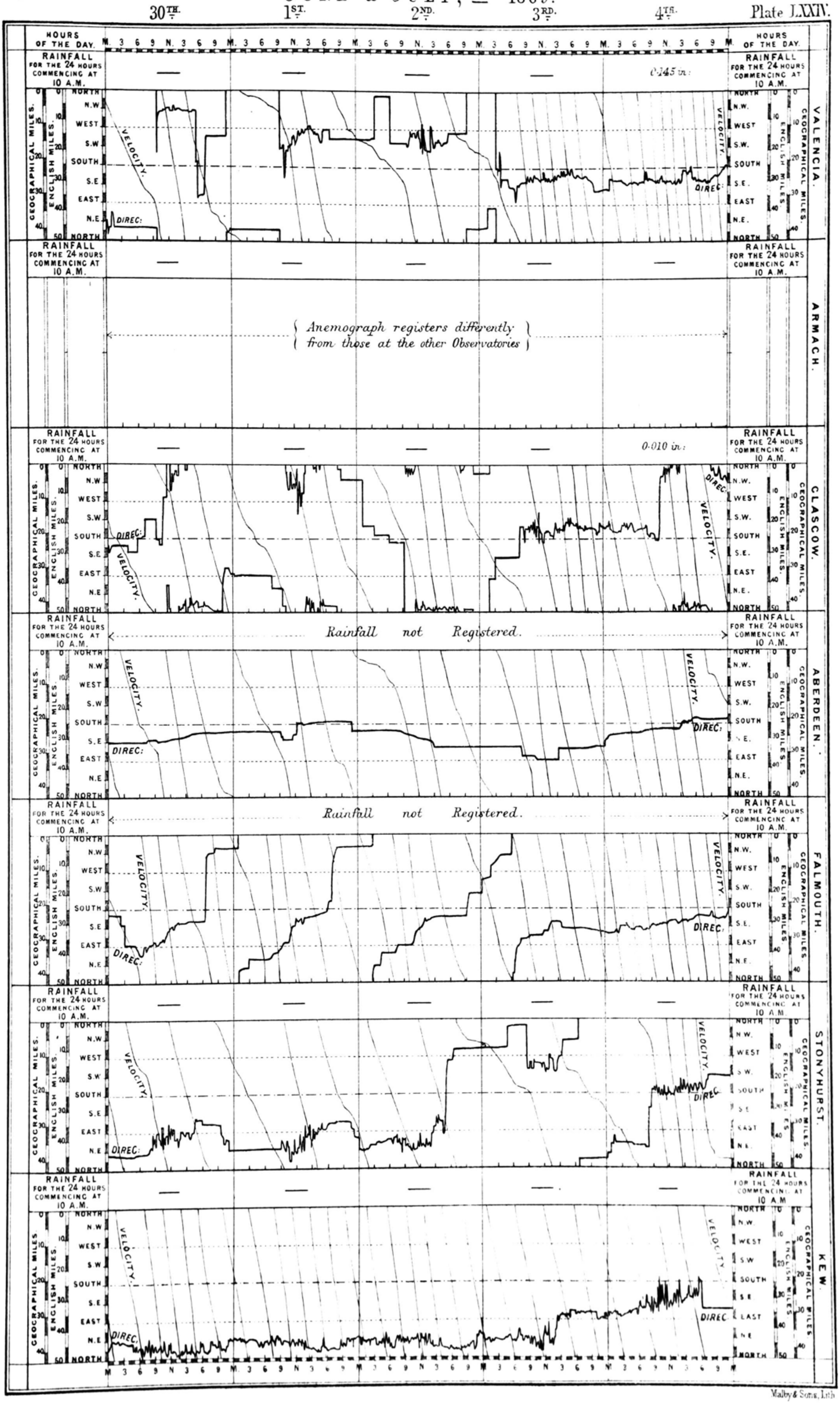
JUNE & JULY, — 1869.

Plate LXXIII.



Malby & Sons, Lith.

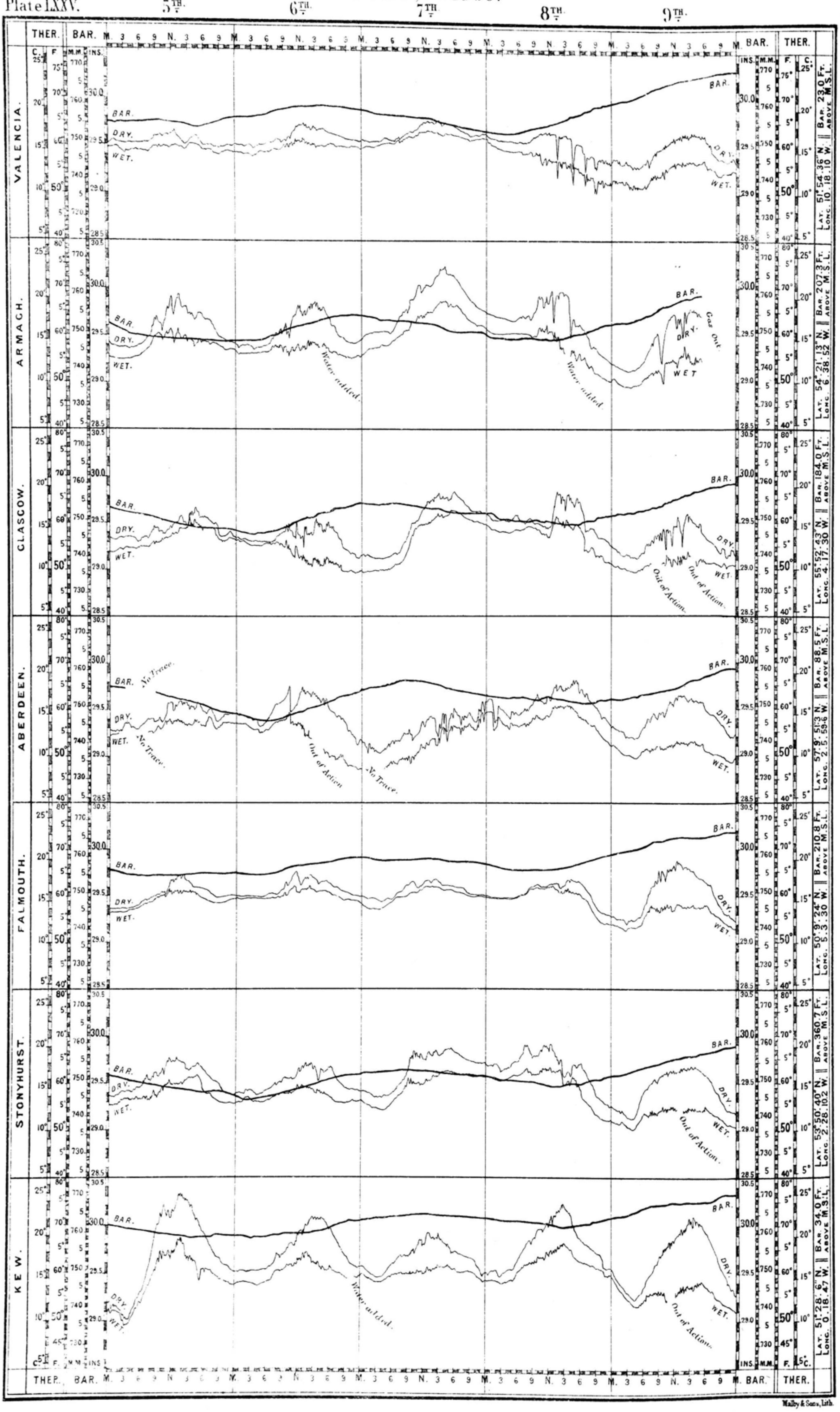
JUNE & JULY, — 1869.



Malby & Sons, Lith.

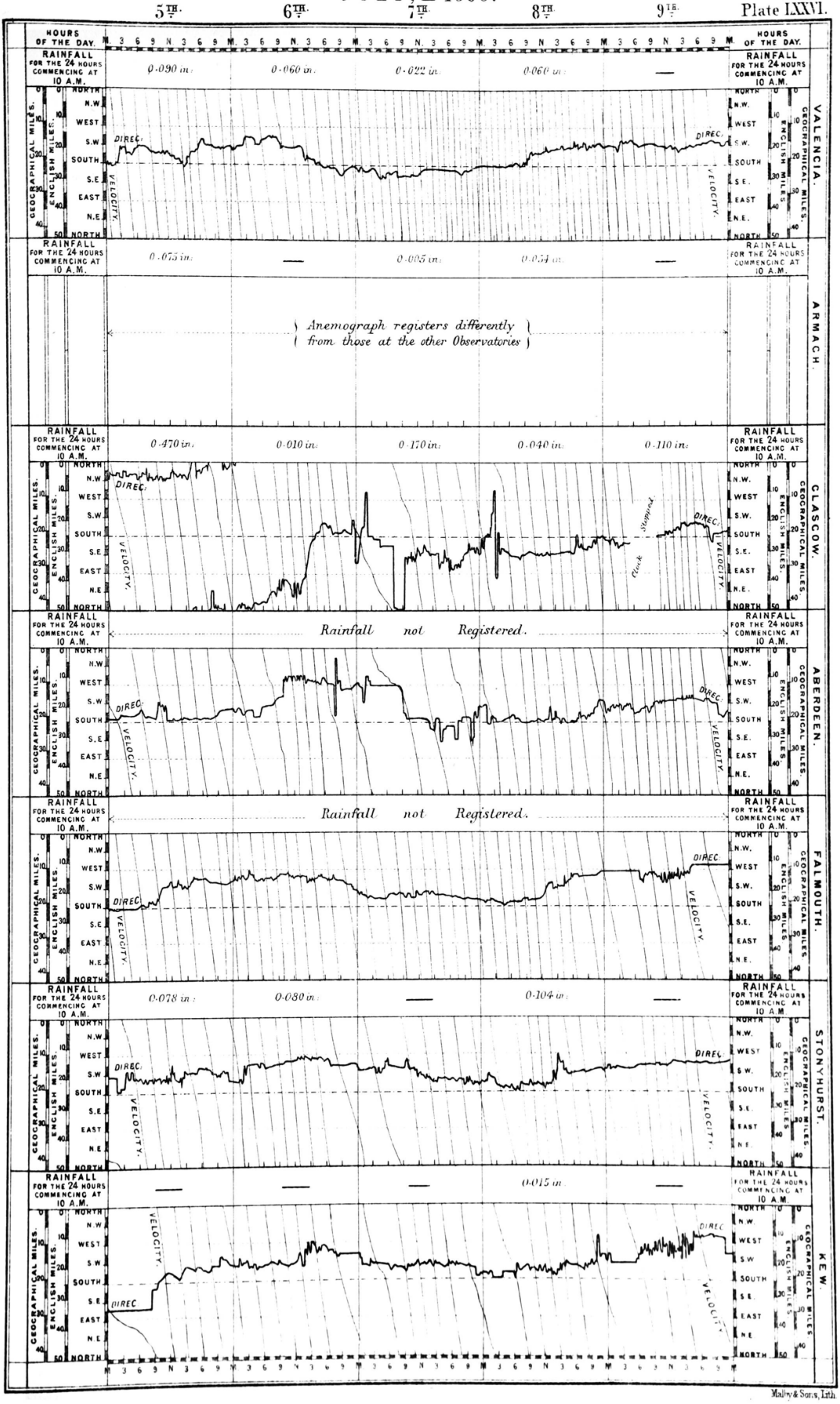
Plate LXXV.

JULY, — 1869.



Malby & Sons, Lith.

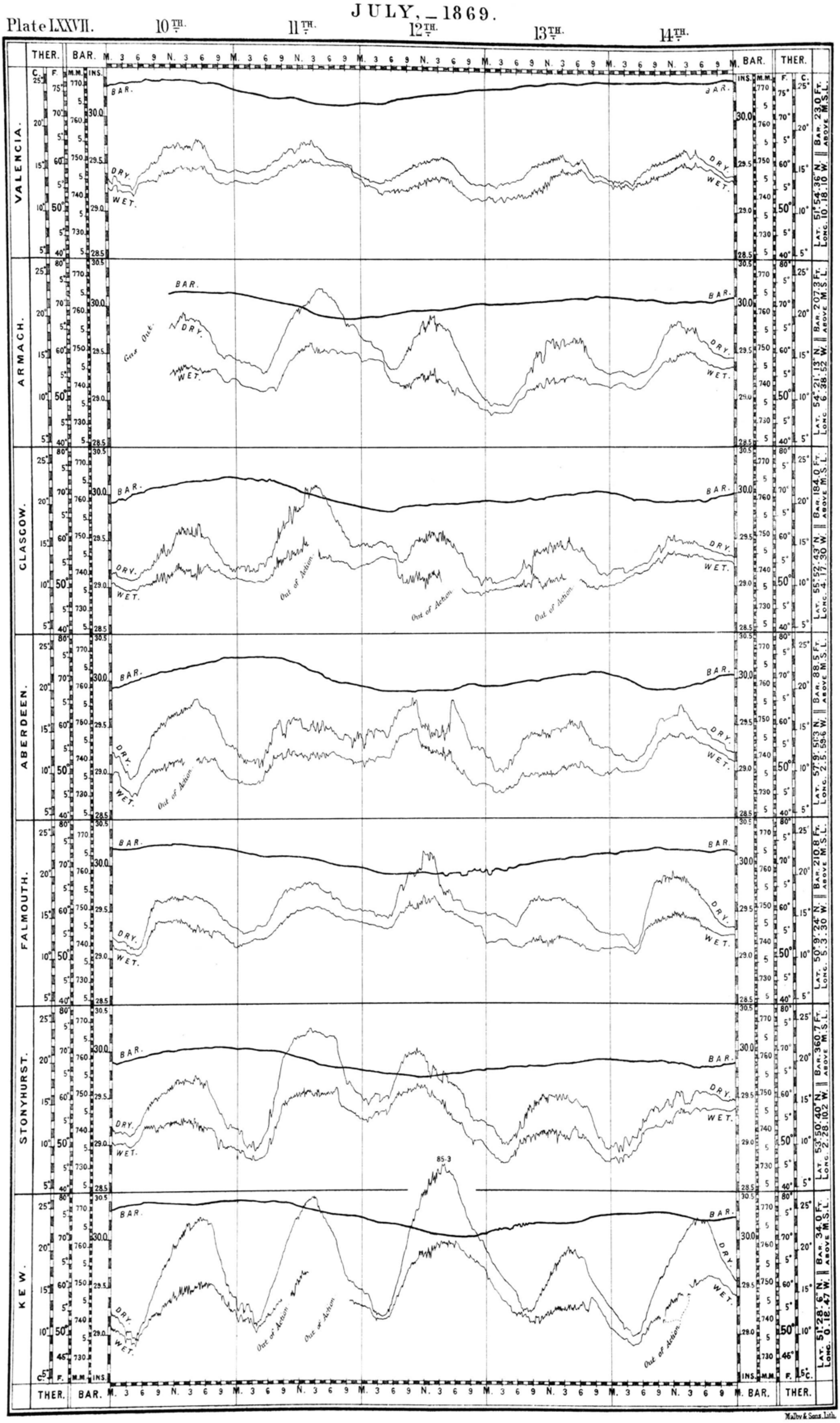
JULY, — 1869. Plate LXXVI.



Malby & Sons, Lith.

Plate LXXVII.

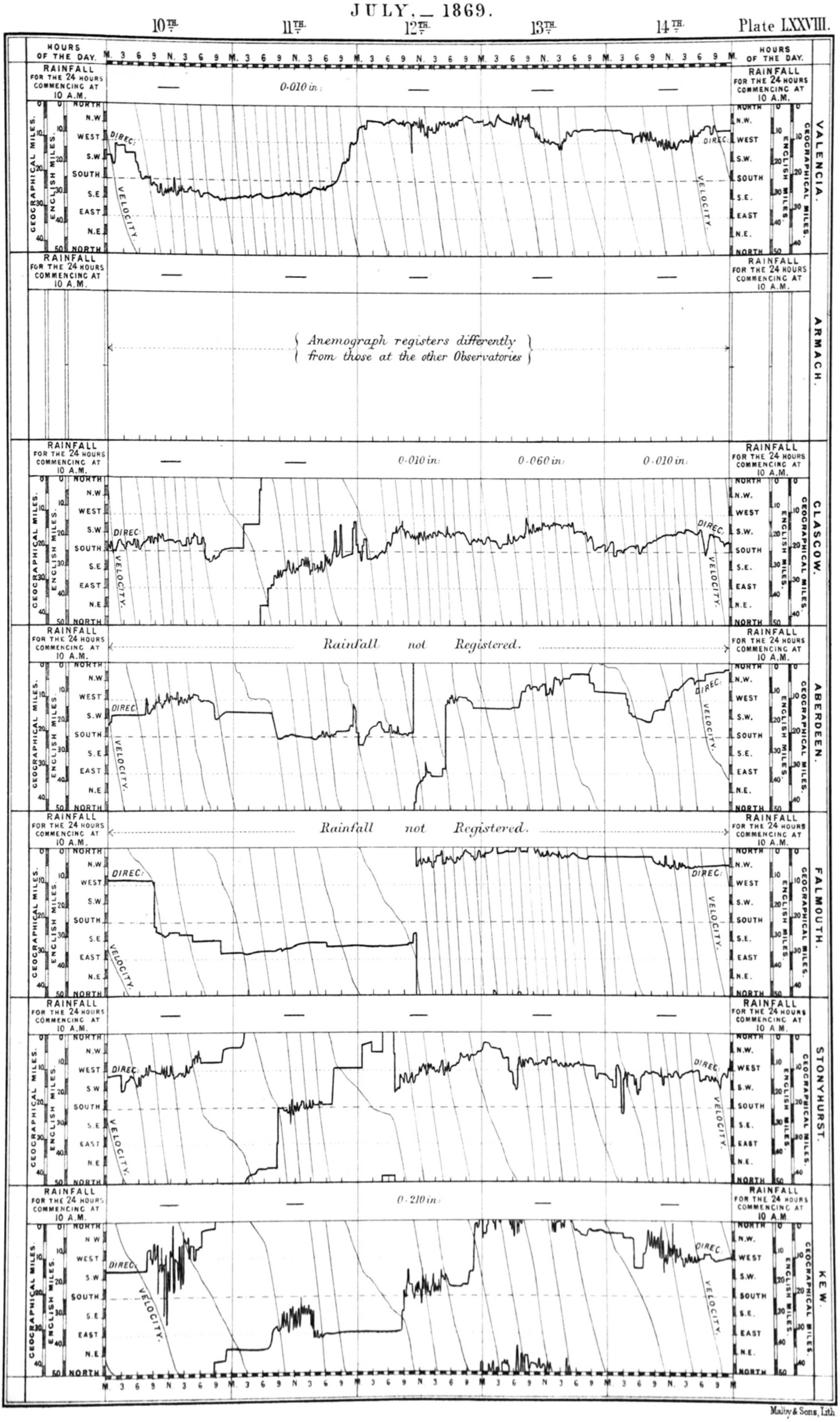
JULY, _ 1869.



Malby & Sons, Lith.

JULY, — 1869.

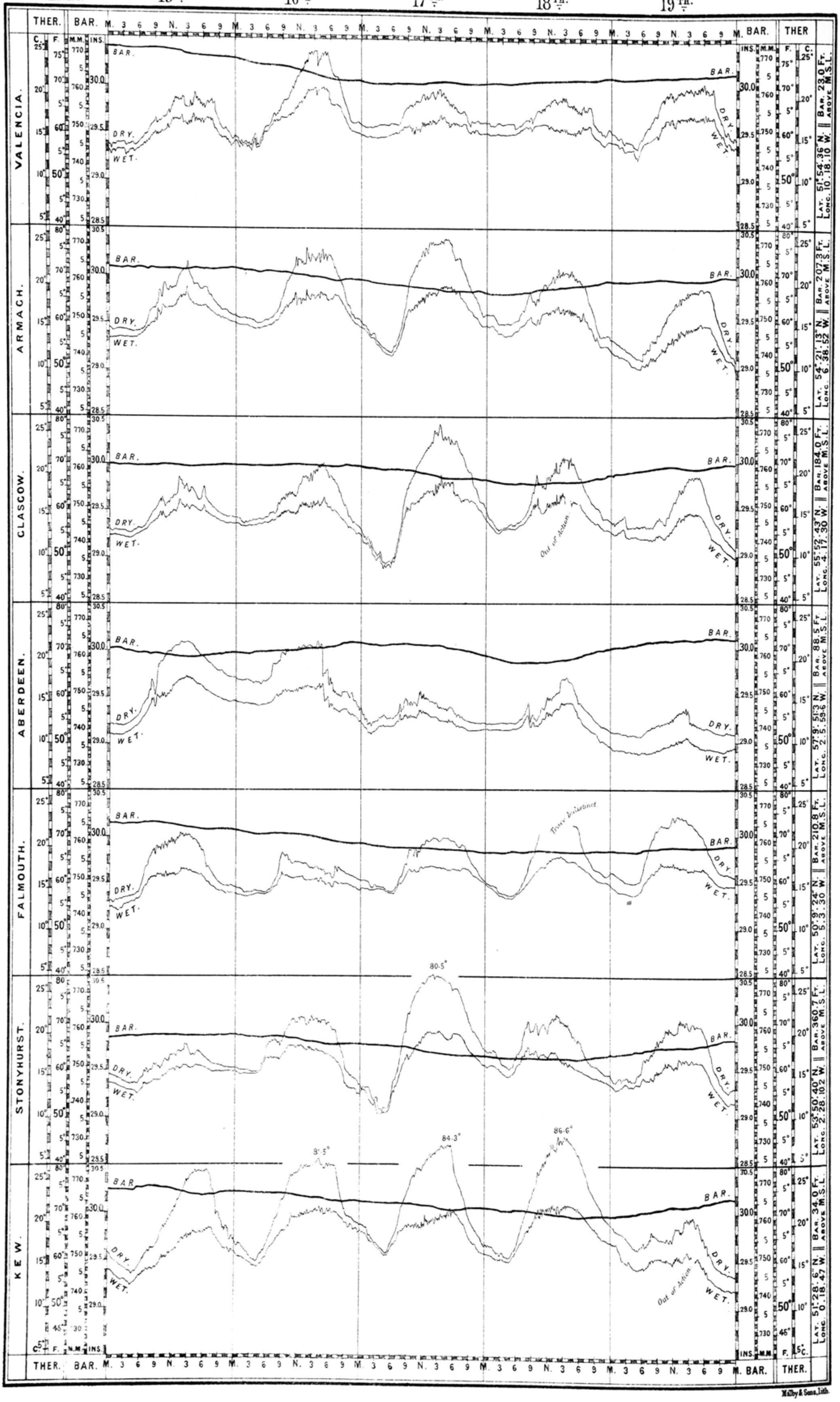
Plate LXXVIII.



Maltby & Sons, Lith.

Plate LXXIX.

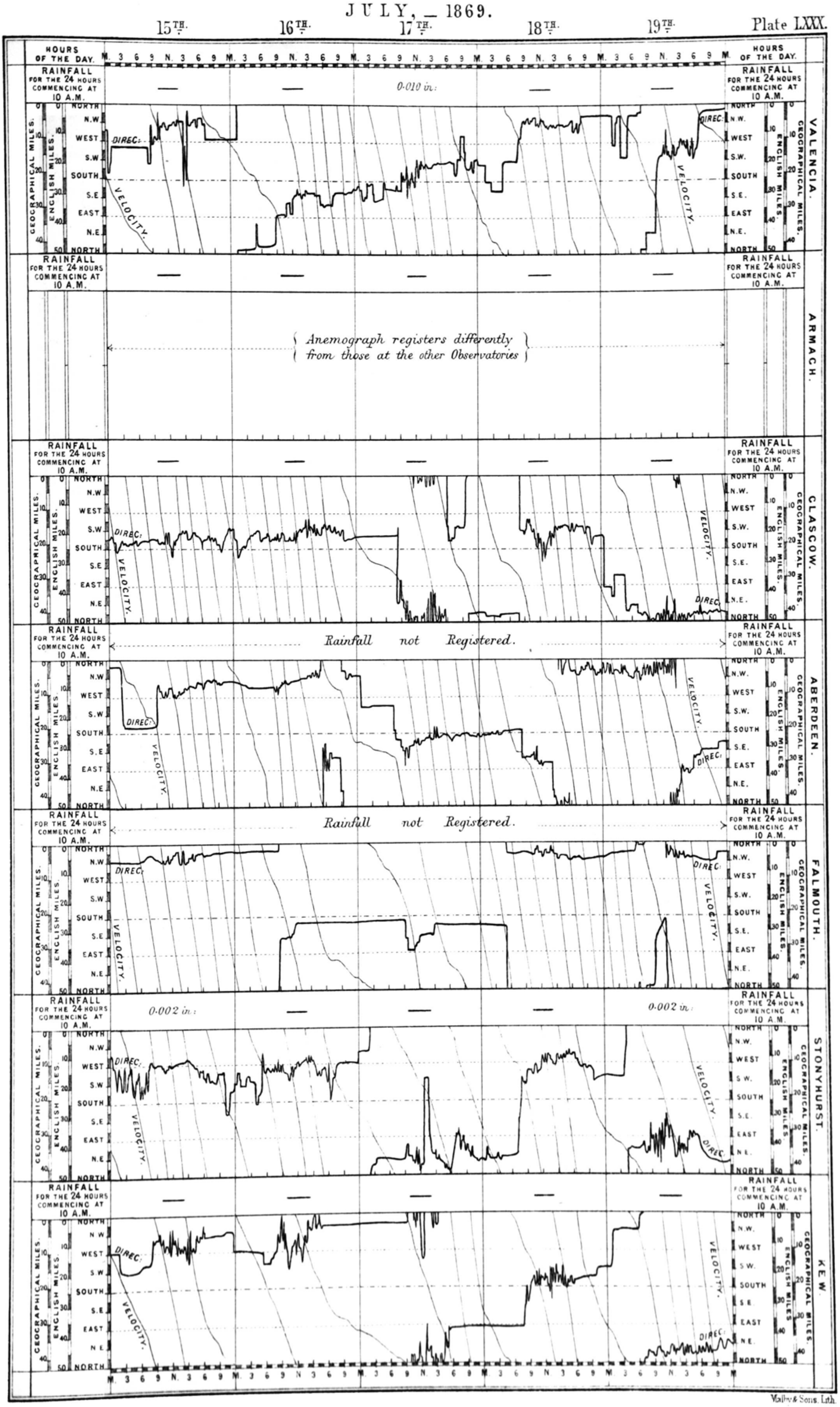
JULY, — 1869.



Malby & Sons, Lith.

JULY, _ 1869.

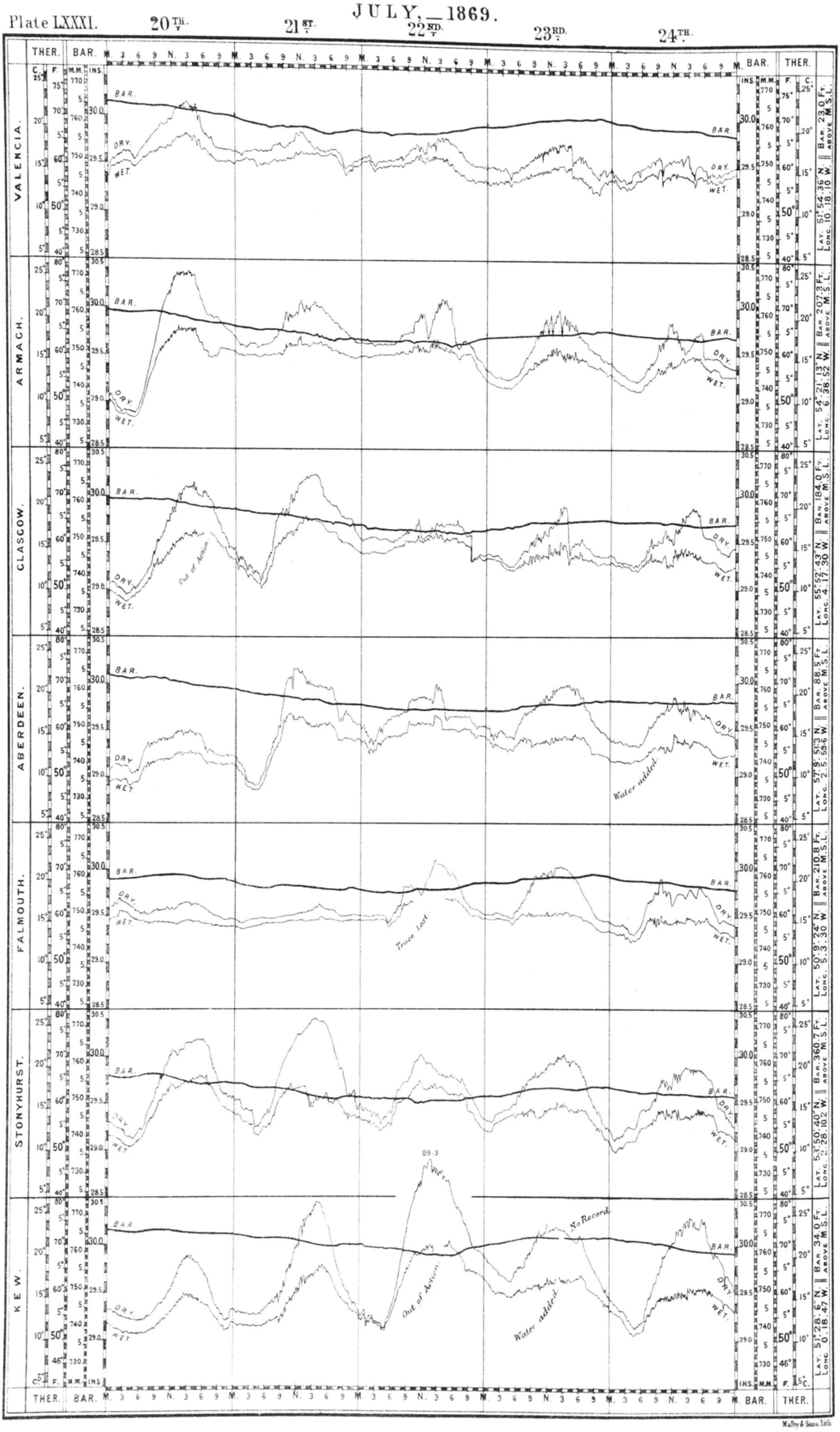
Plate LXXX.



Malby & Sons. Lith.

Plate LXXXI.

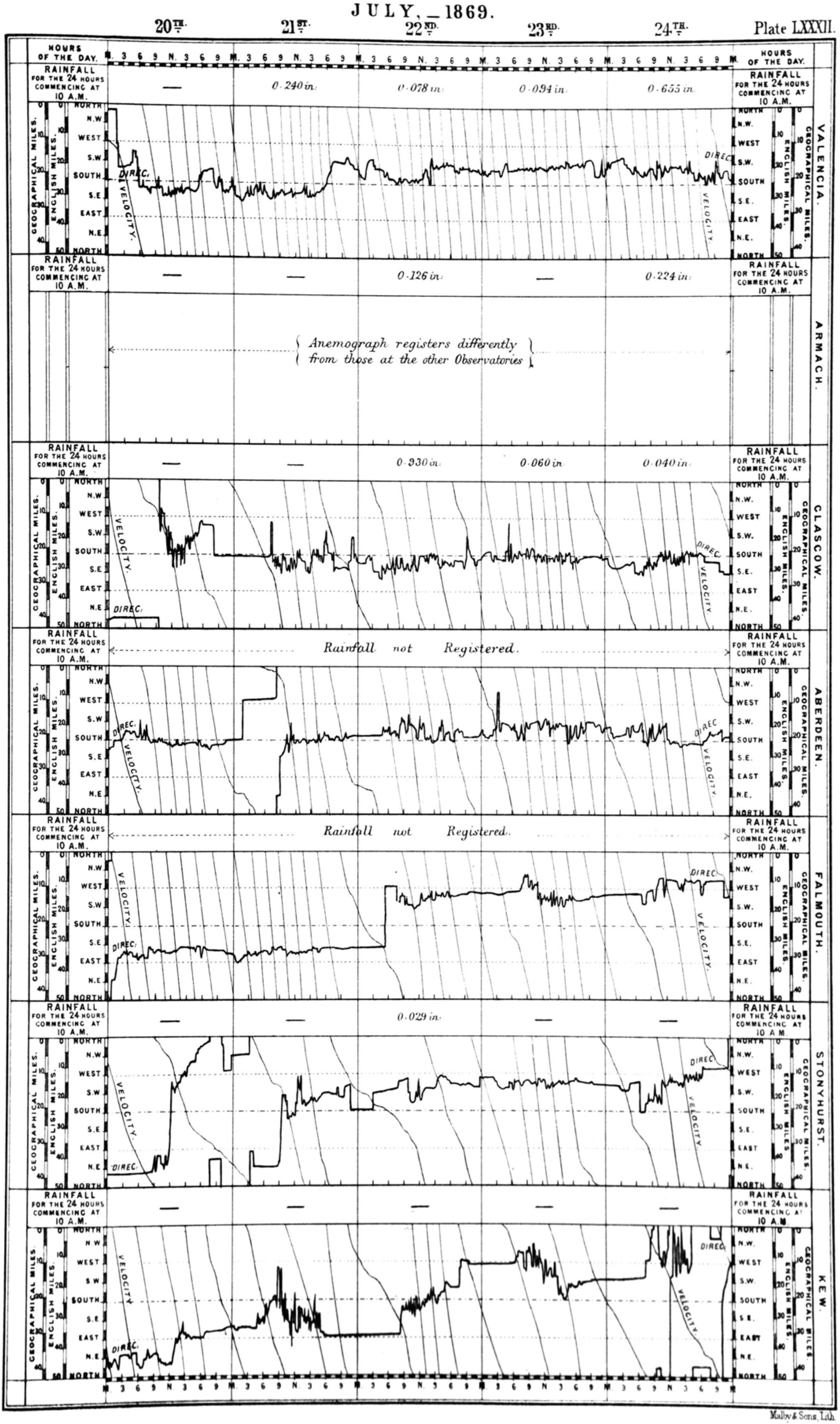
JULY, — 1869.



Malby & Sons. lith.

JULY, _1869.

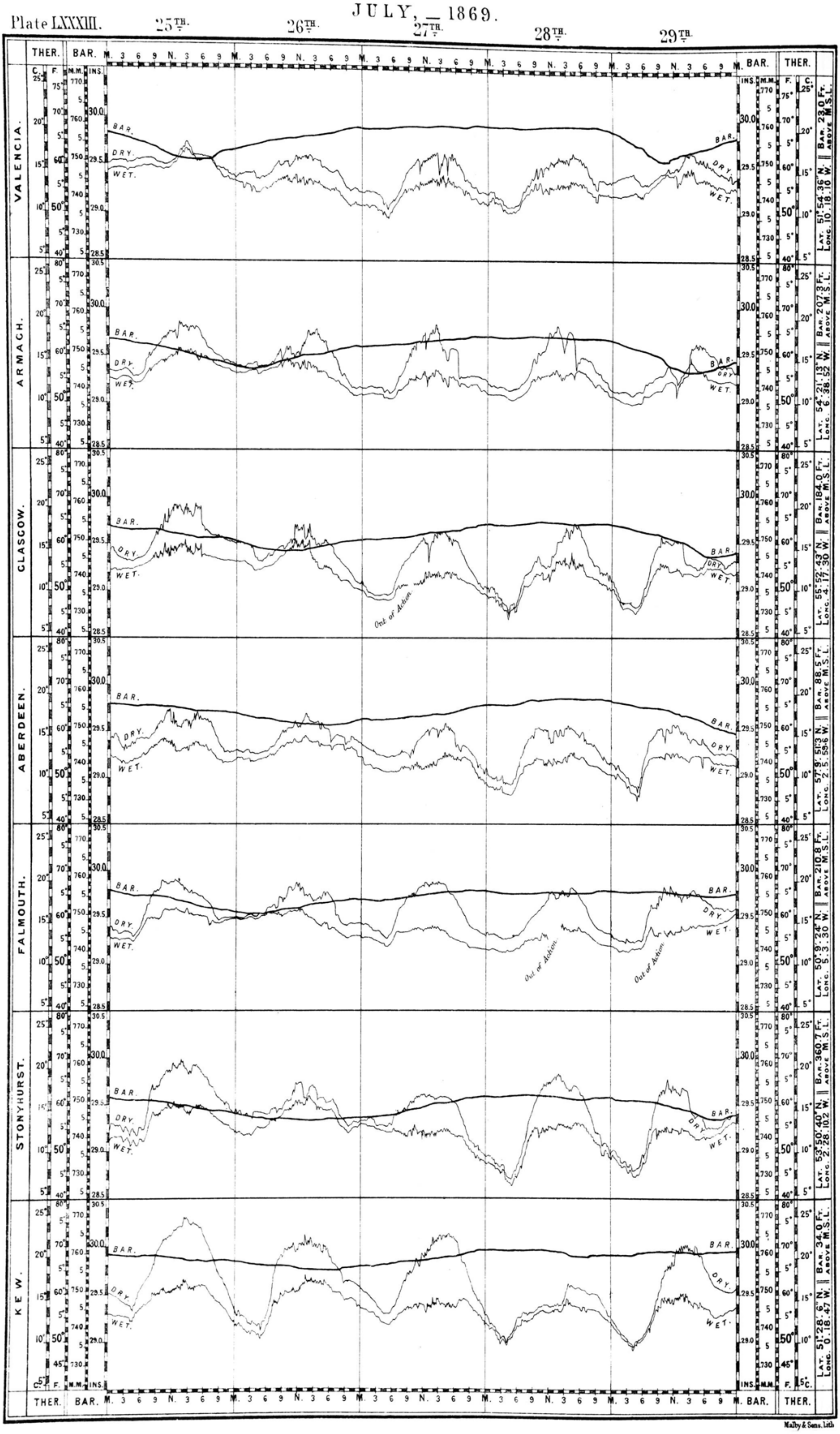
Plate LXXXII.



Malby & Sons, Lith.

Plate LXXXIII.

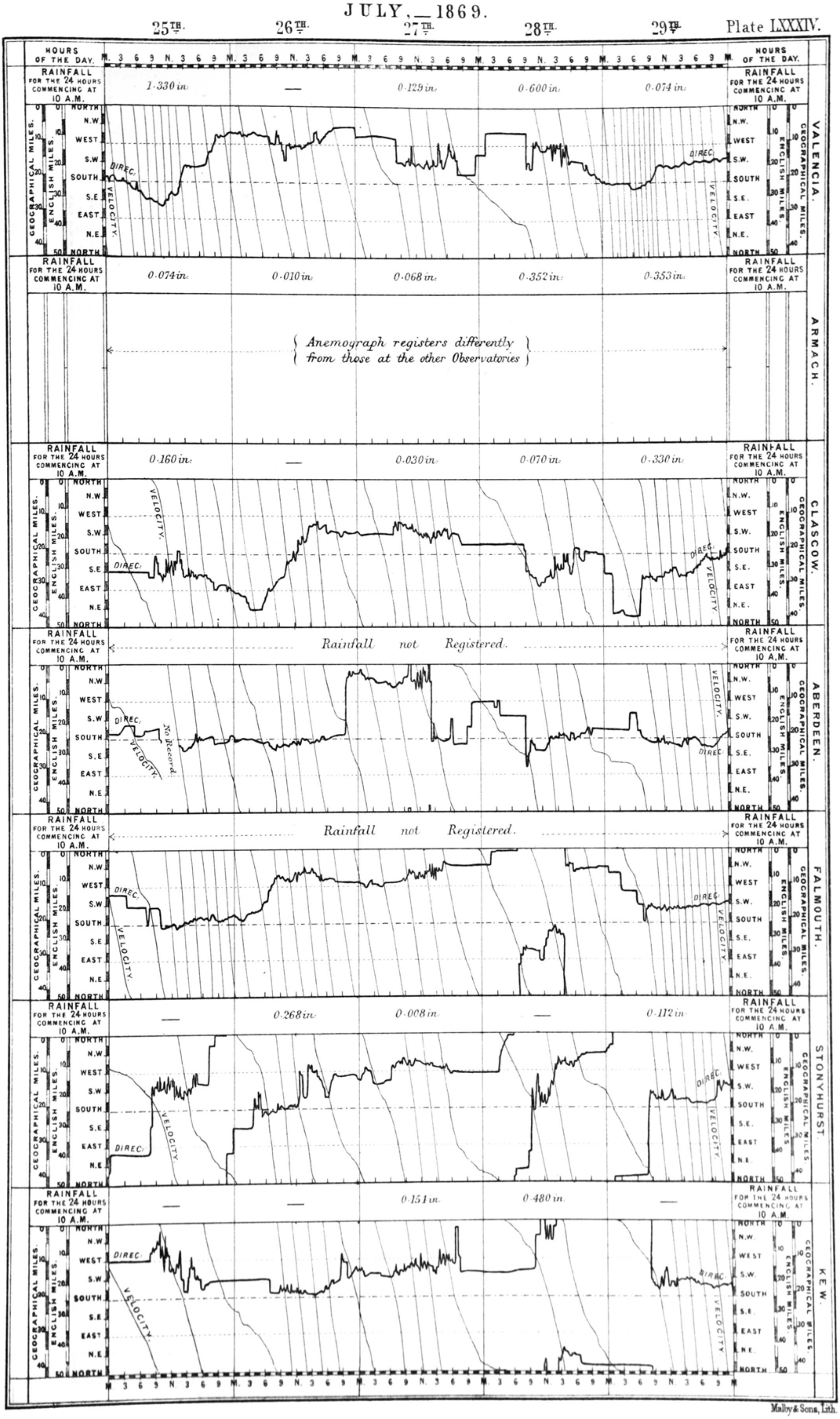
JULY, — 1869.



Malby & Sons, Lith

JULY, — 1869.

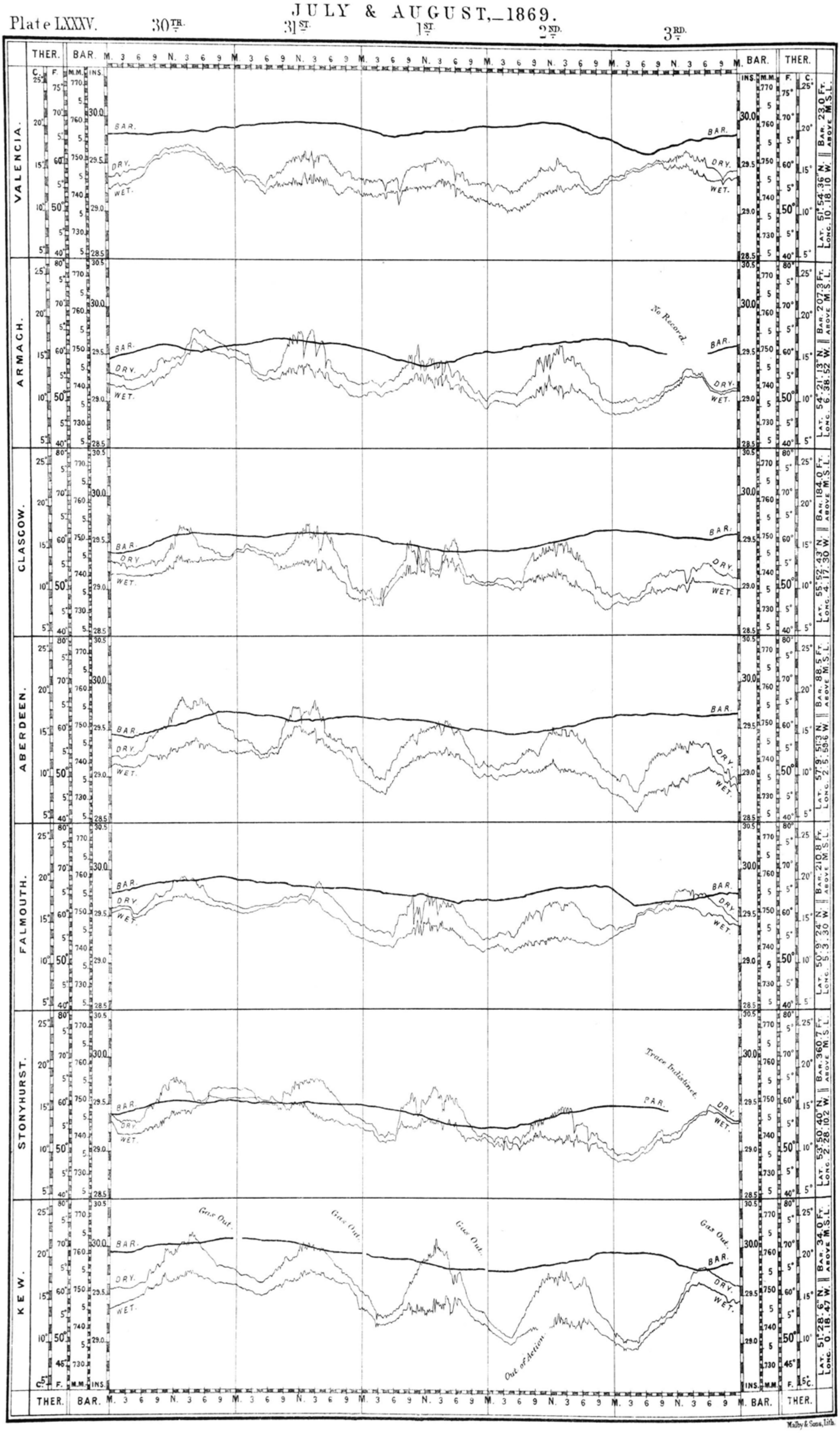
Plate LXXXIV.



Malby & Sons, Lith.

Plate LXXXV.

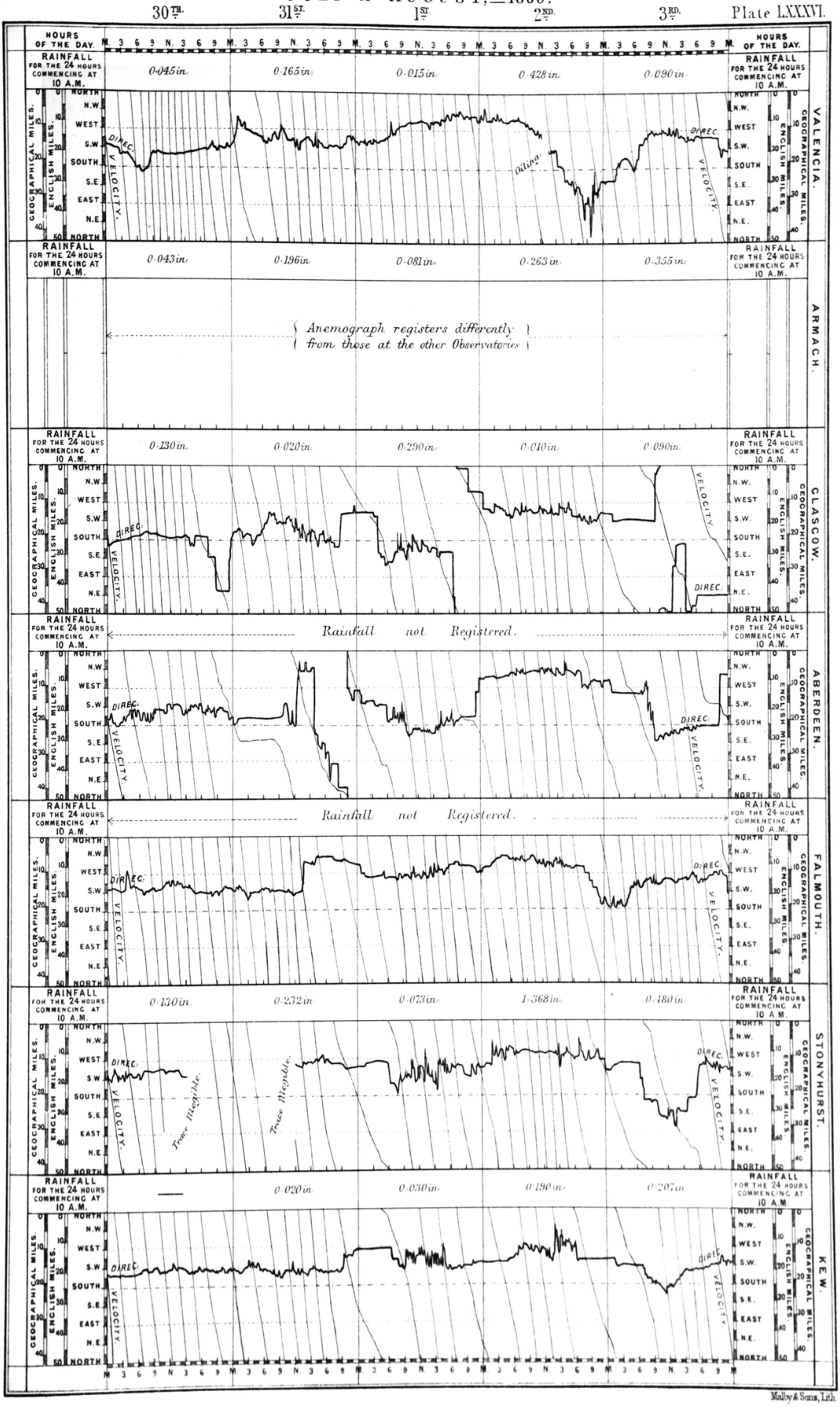
JULY & AUGUST,—1869.



Malby & Sons, Lith.

JULY & AUGUST,—1869.

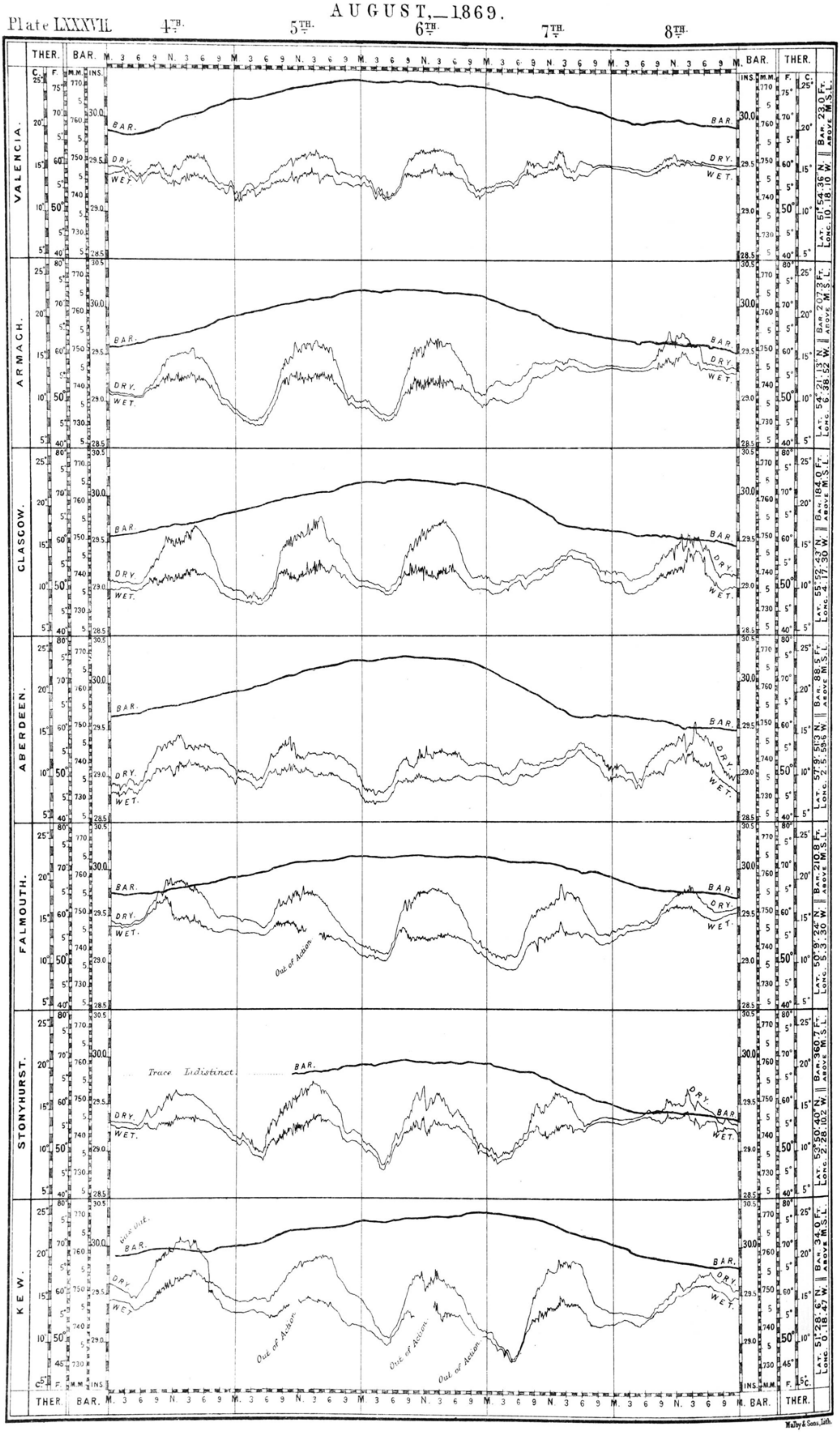
Plate LXXXVI.



Malby & Sons, Lith.

Plate LXXXVII.

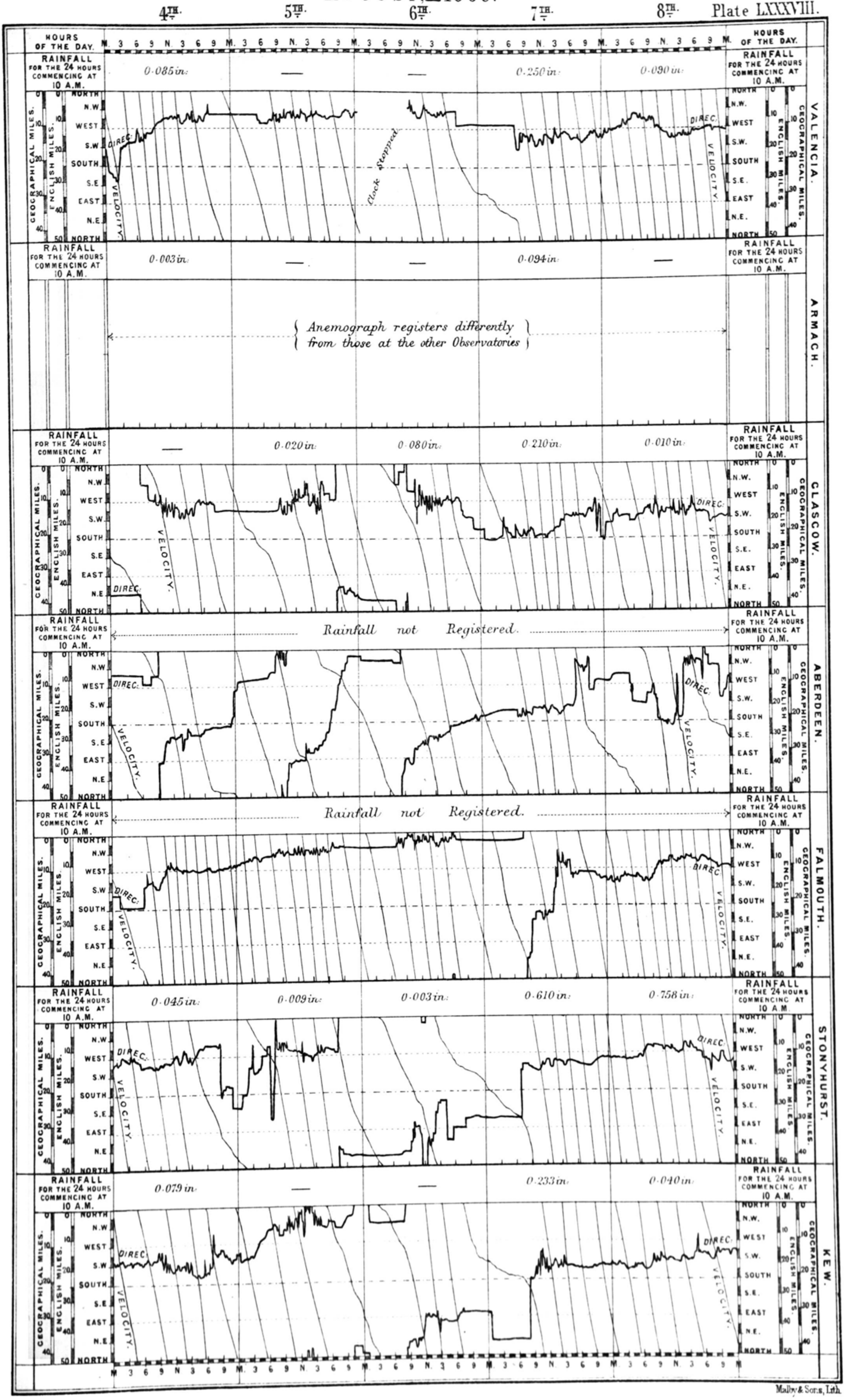
AUGUST, — 1869.



Malby & Sons, Lith.

AUGUST,—1869.

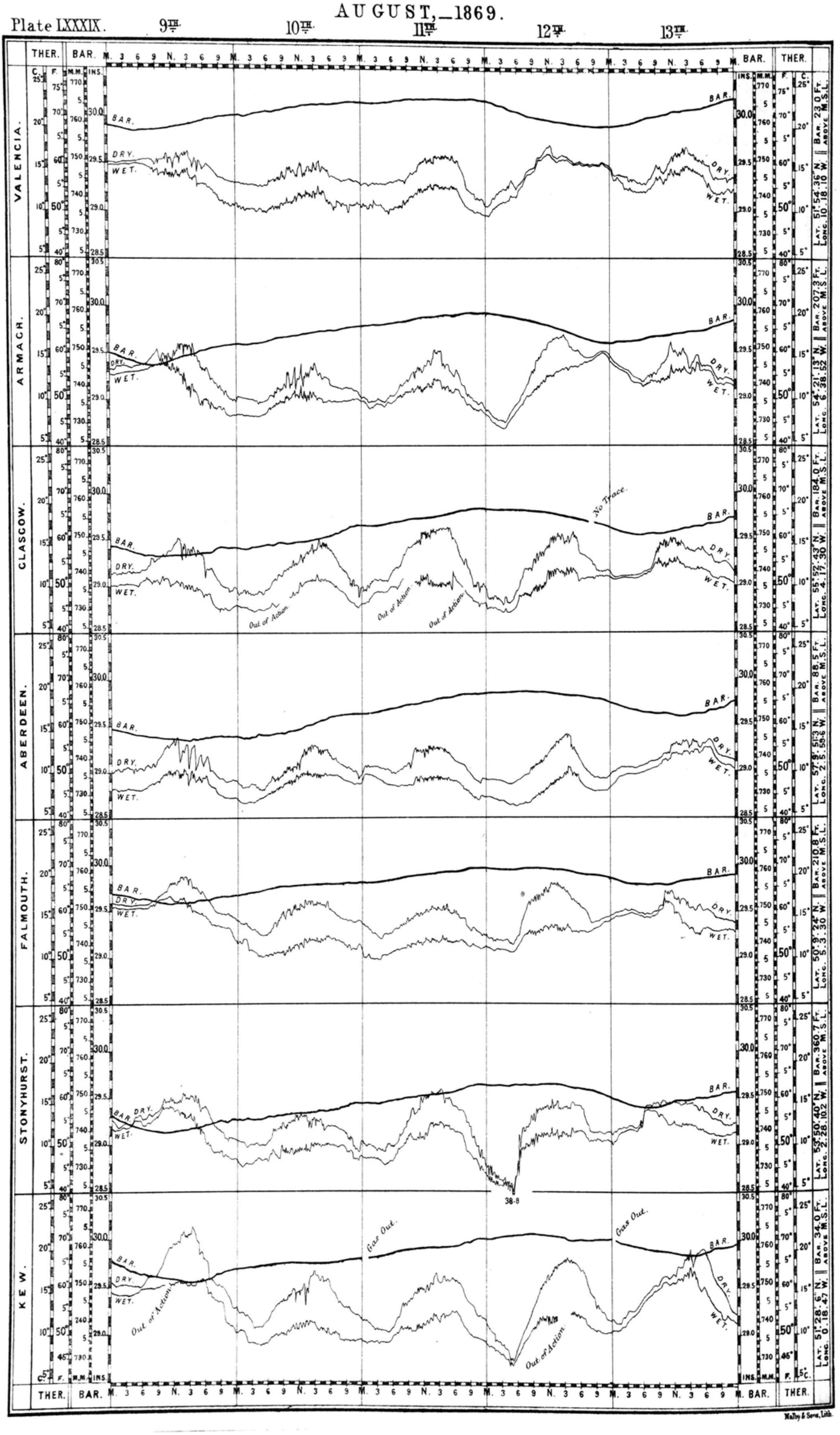
Plate LXXXVIII.



Malby & Sons, Lith.

Plate LXXXIX.

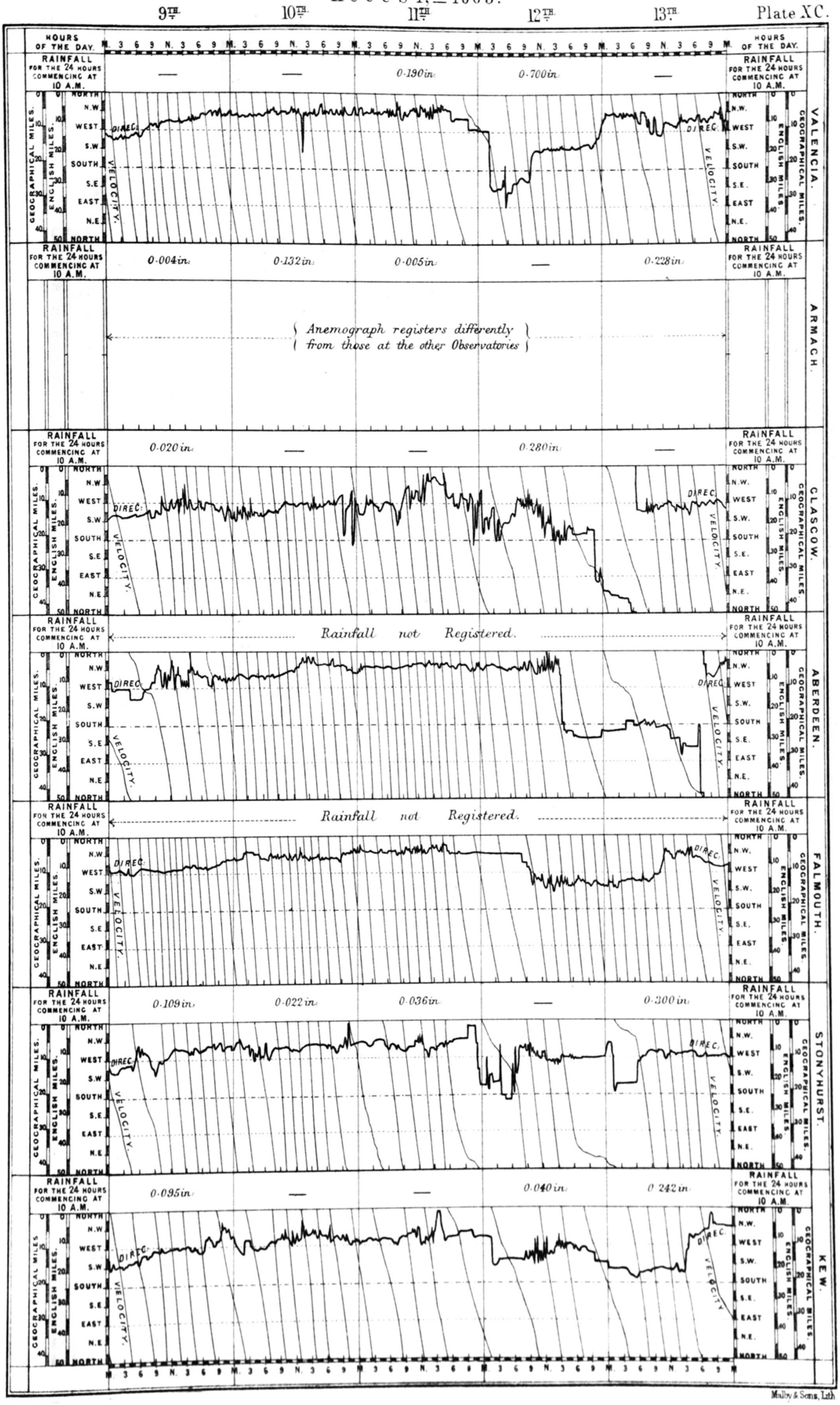
AUGUST,—1869.



Malby & Sons, Lith.

AUGUST, — 1869.

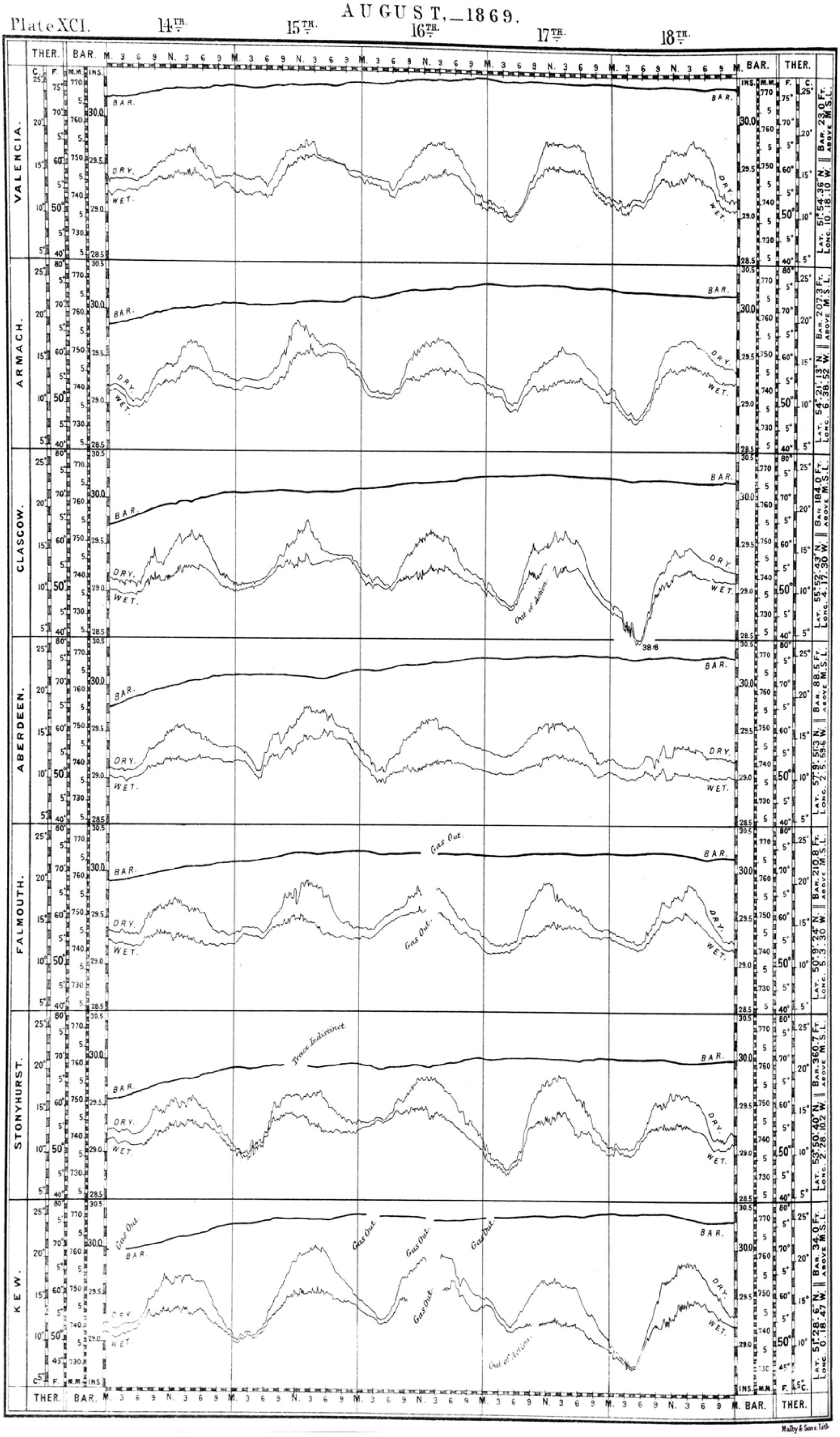
Plate XC.



Malby & Sons, Lith.

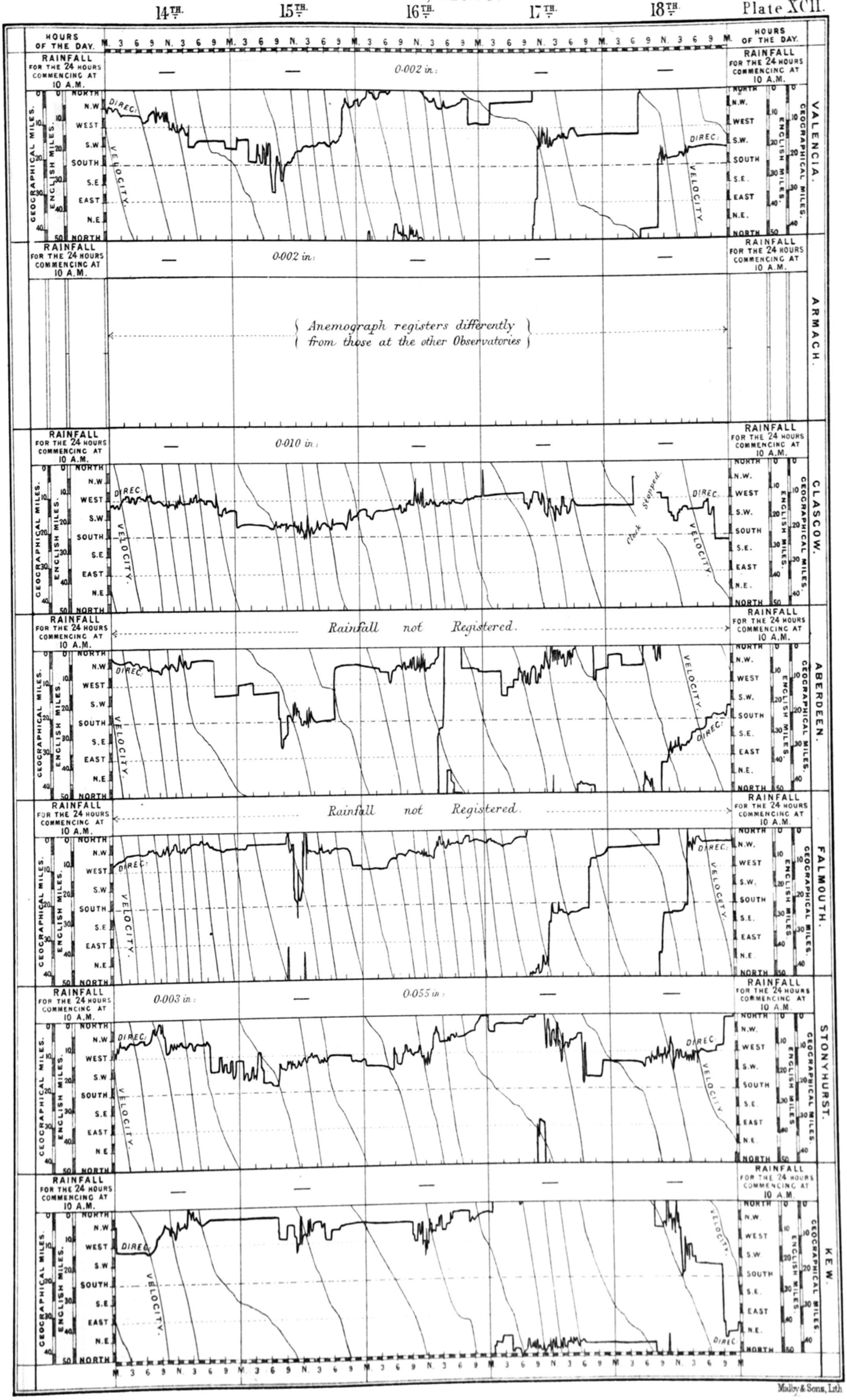
Plate XCI.

AUGUST, — 1869.



Maltby & Sons. Lith.

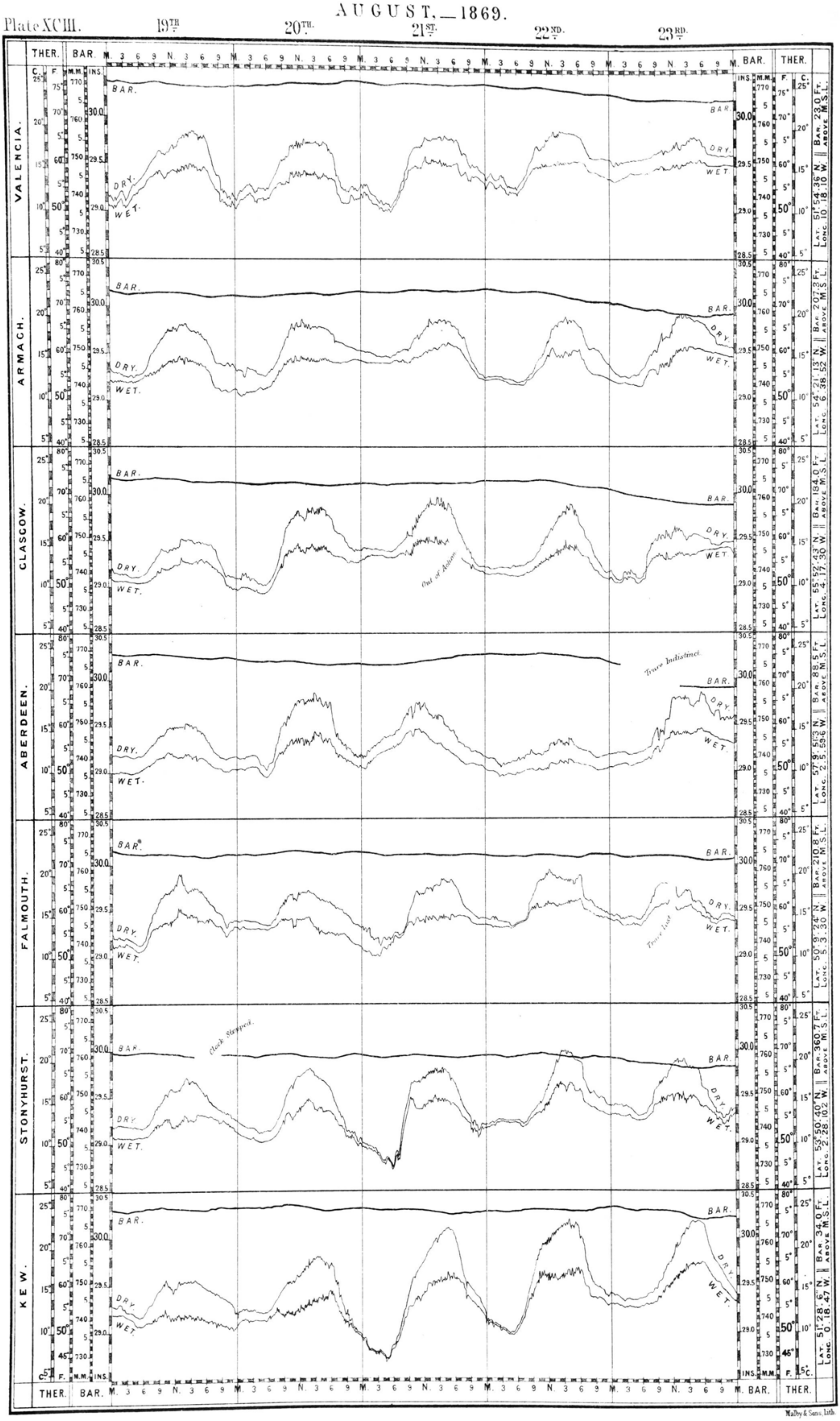
AUGUST,—1869.



Malby & Sons, Lith

Plate XCIII.

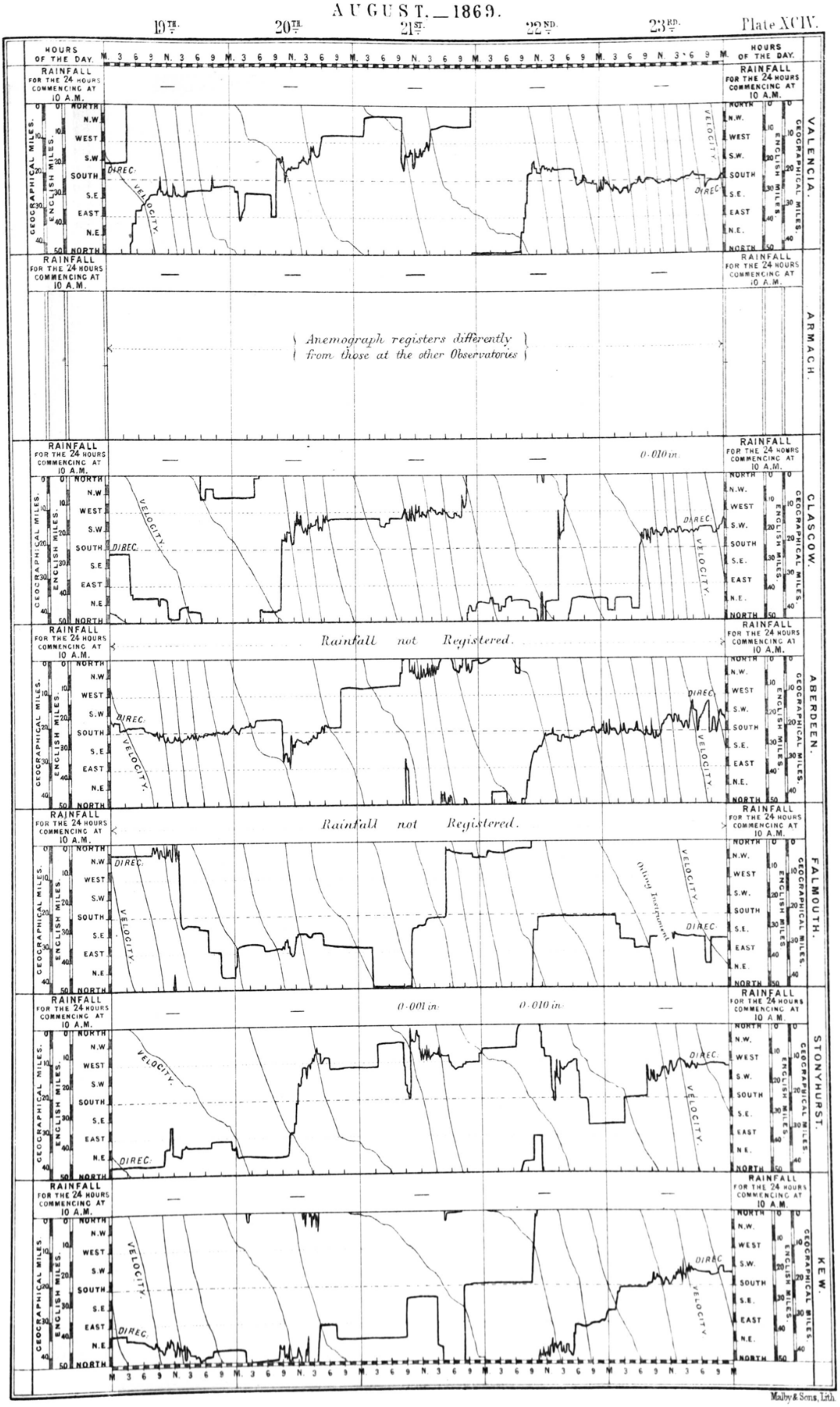
AUGUST,—1869.



Malby & Sons, Lith.

AUGUST.—1869.

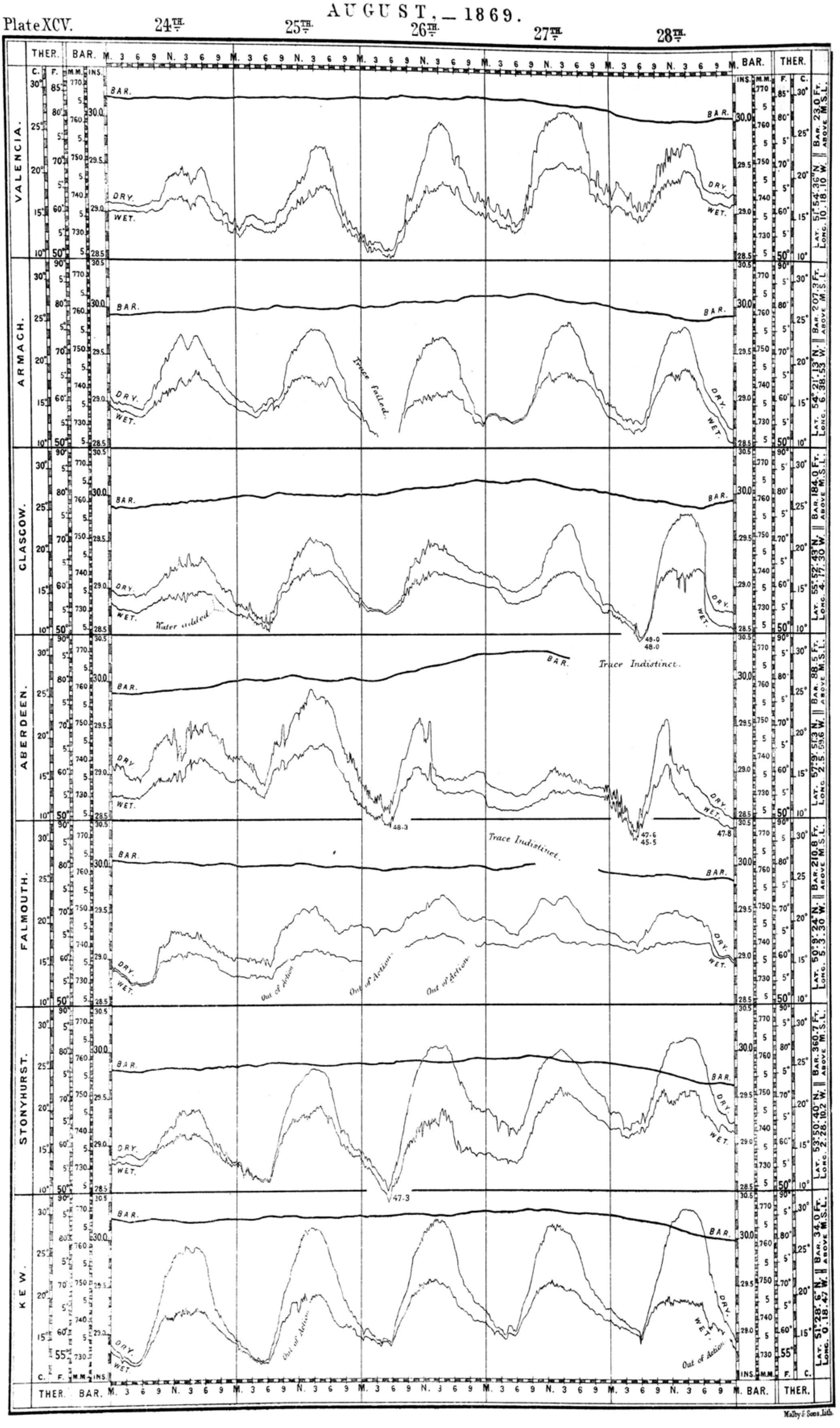
Plate XCIV.



Malby & Sons, Lith.

Plate XCV.

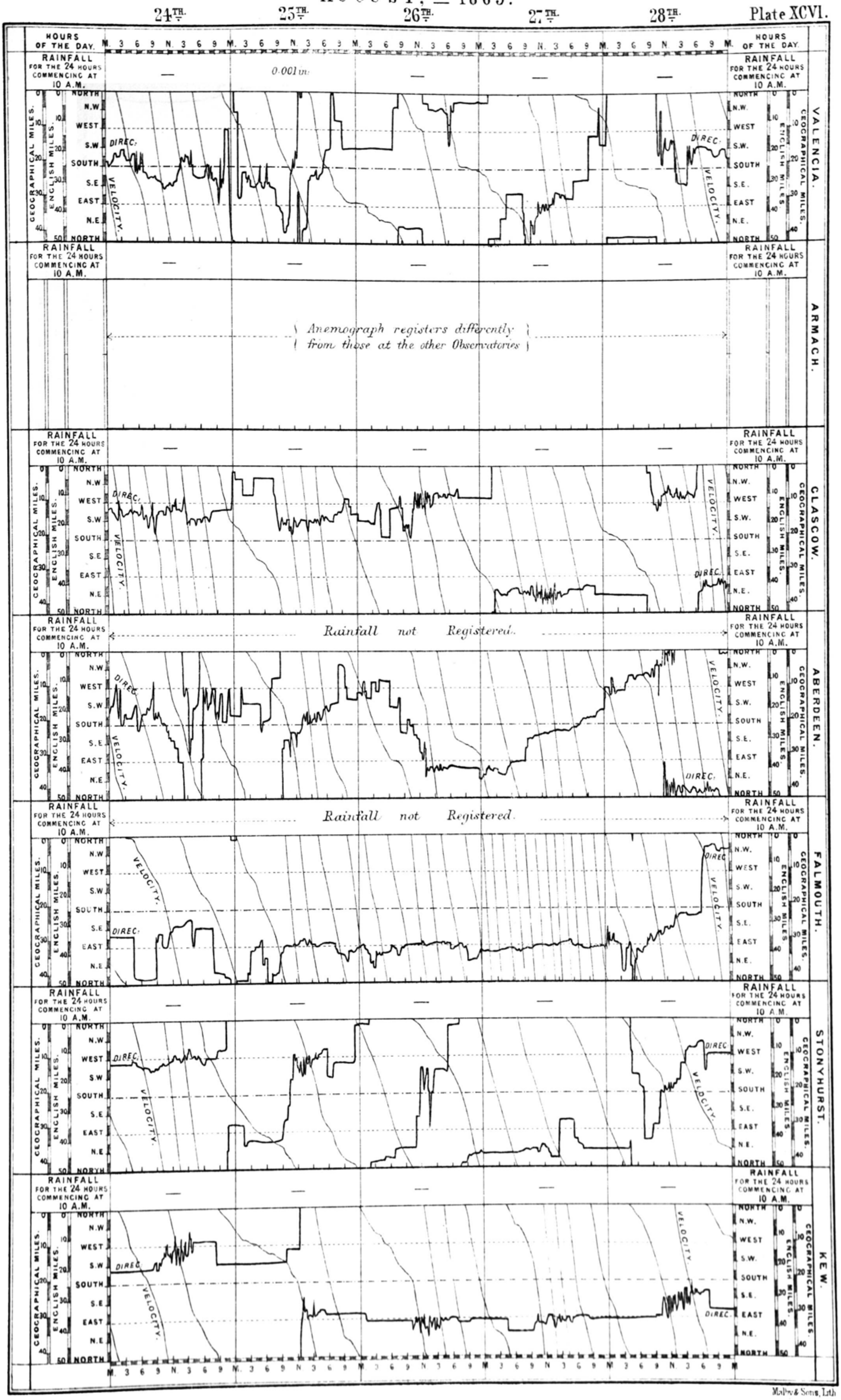
AUGUST, — 1869.



Malby & Sons, Lith.

AUGUST, — 1869.

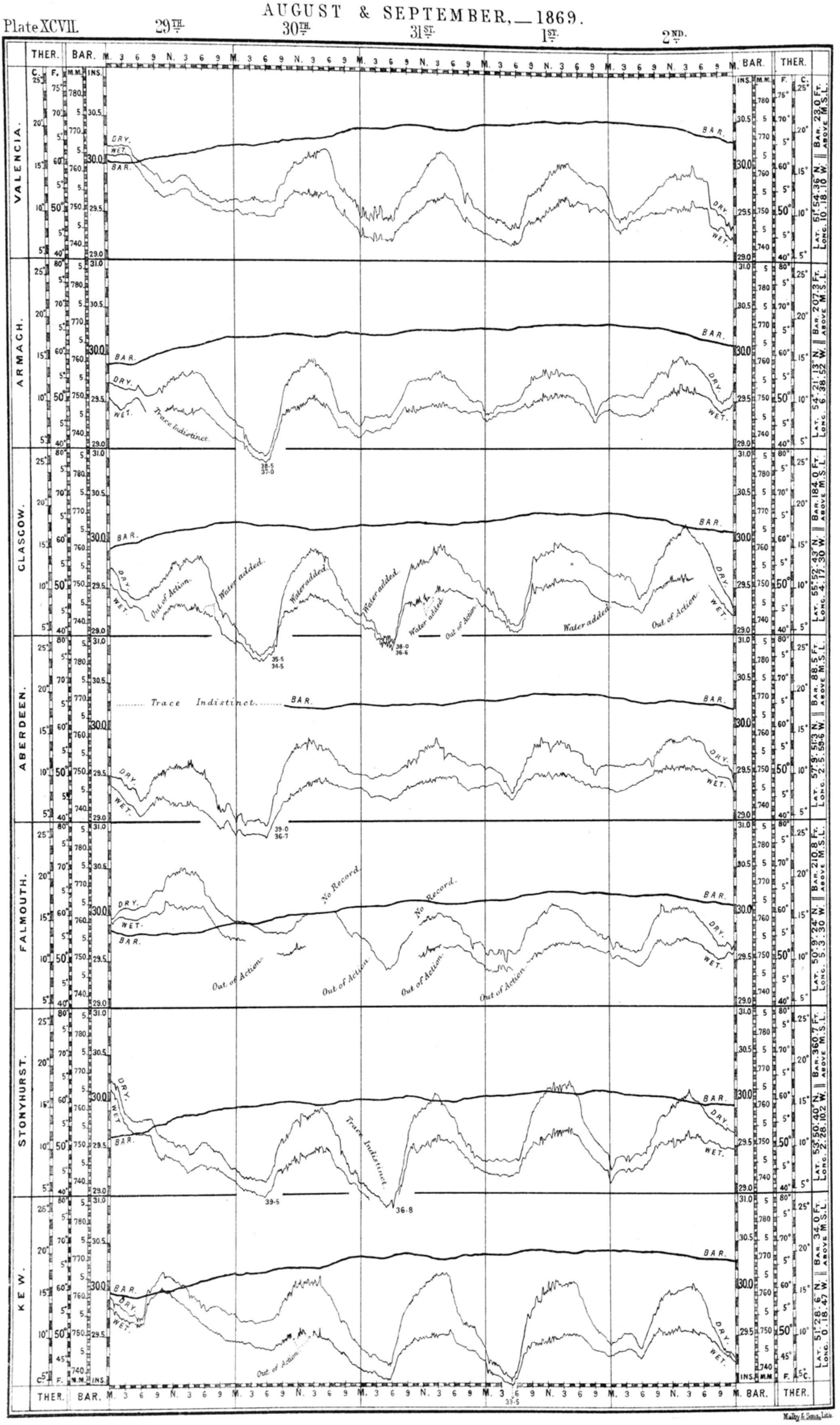
Plate XCVI.



Malby & Sons, Lith.

Plate XCVII.

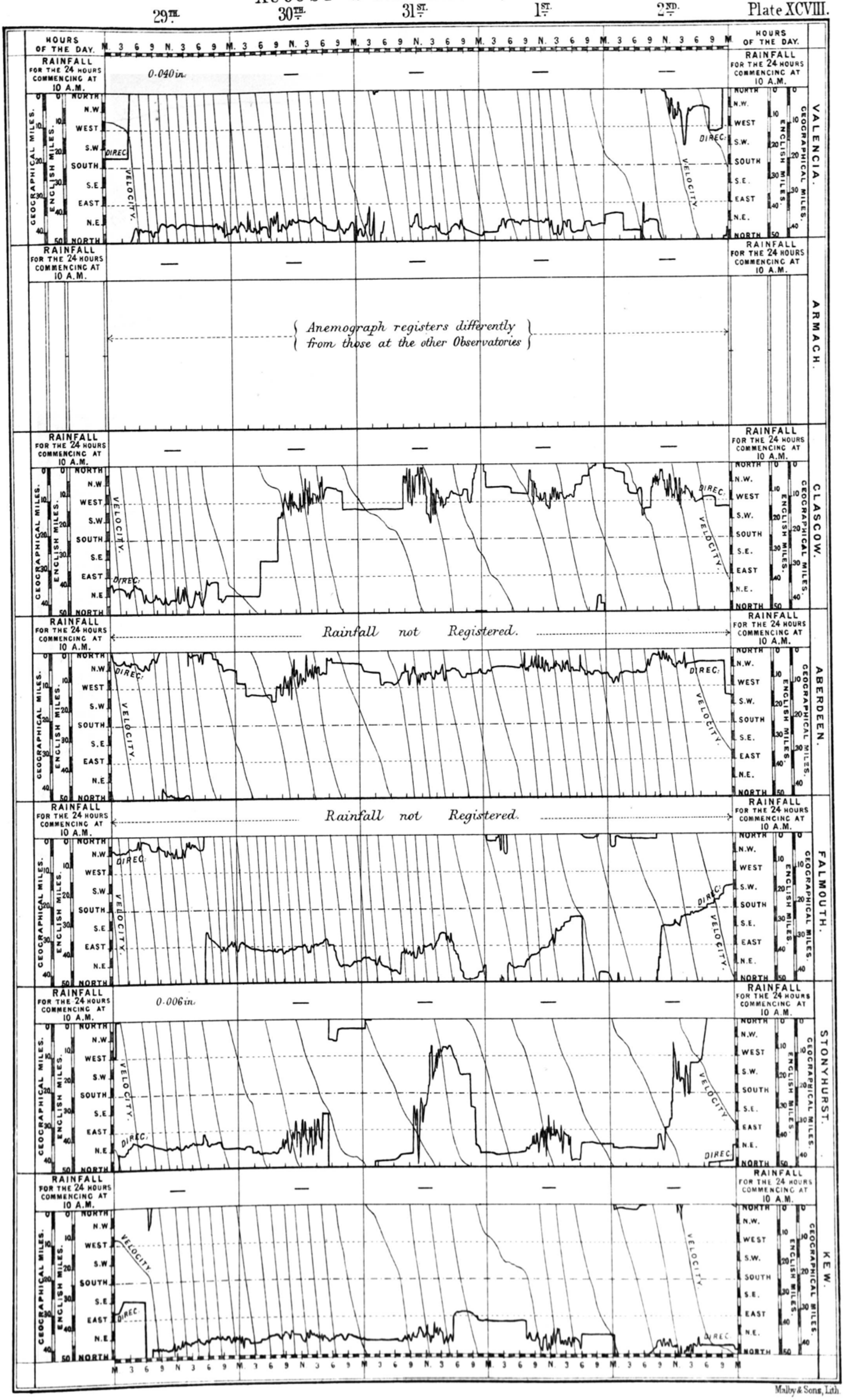
AUGUST & SEPTEMBER, — 1869.



Maltby & Sons, Lith.

AUGUST & SEPTEMBER,—1869.

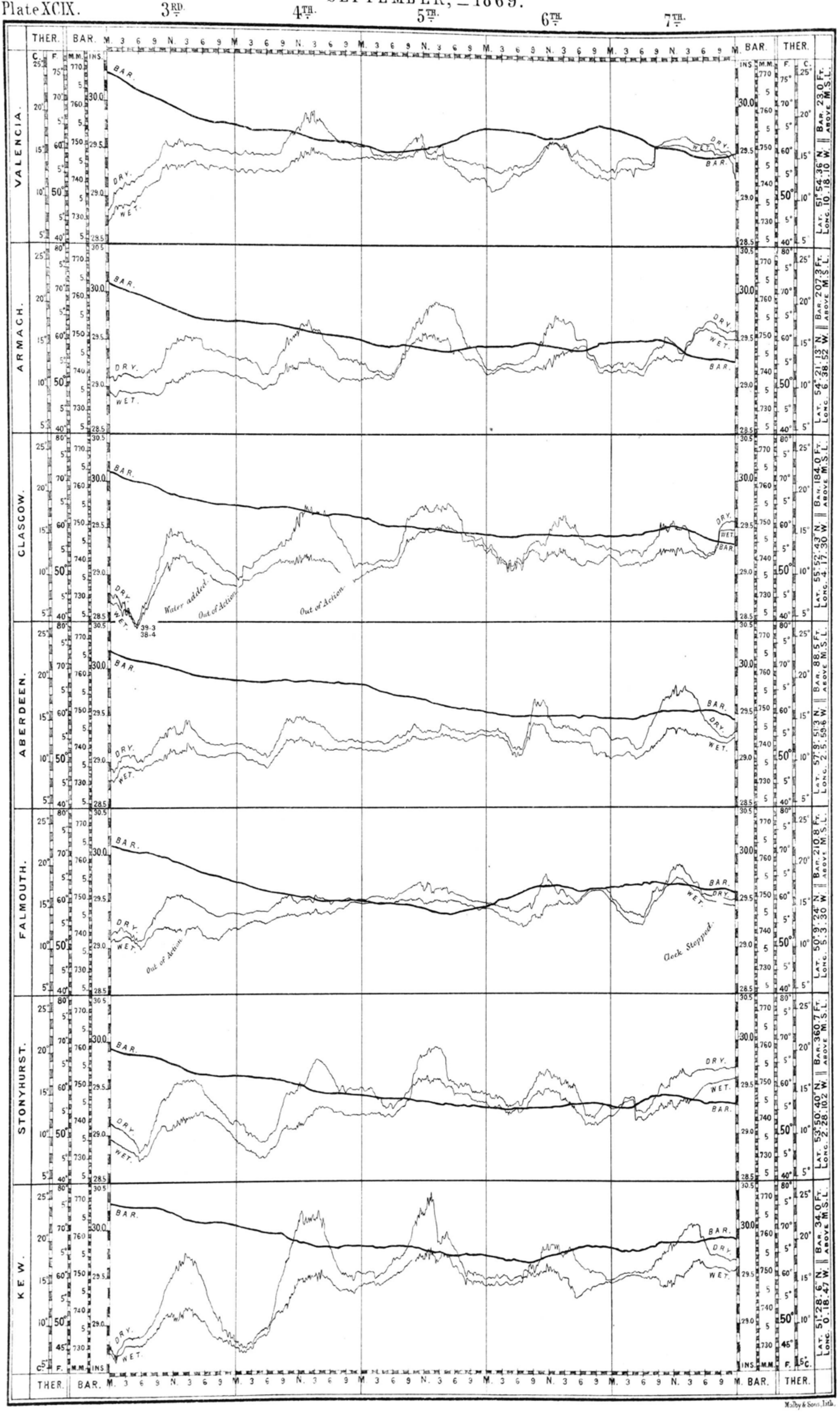
Plate XCVIII.



Malby & Sons, Lith.

Plate XCIX.

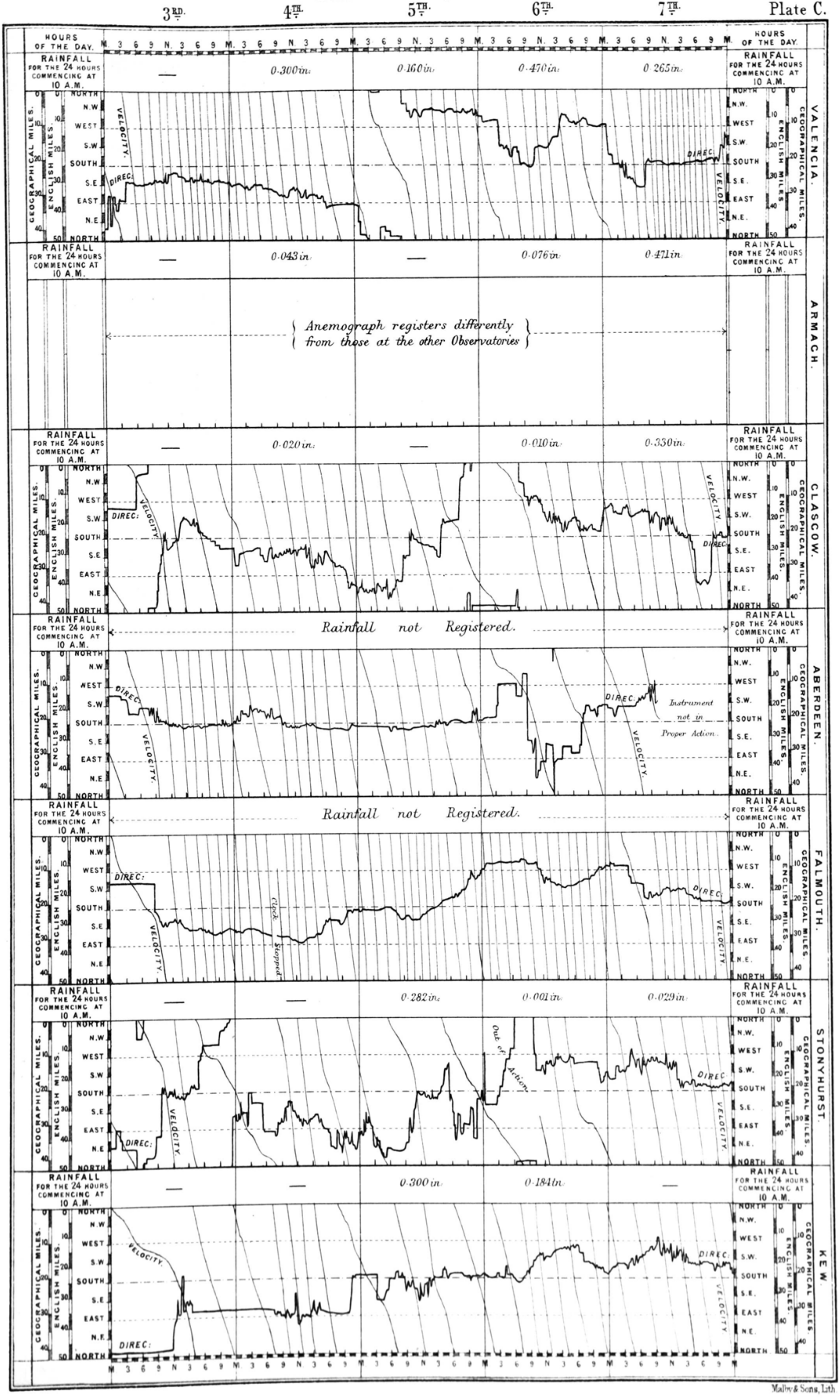
SEPTEMBER, — 1869.



Malby & Sons, Lith.

SEPTEMBER, — 1869.

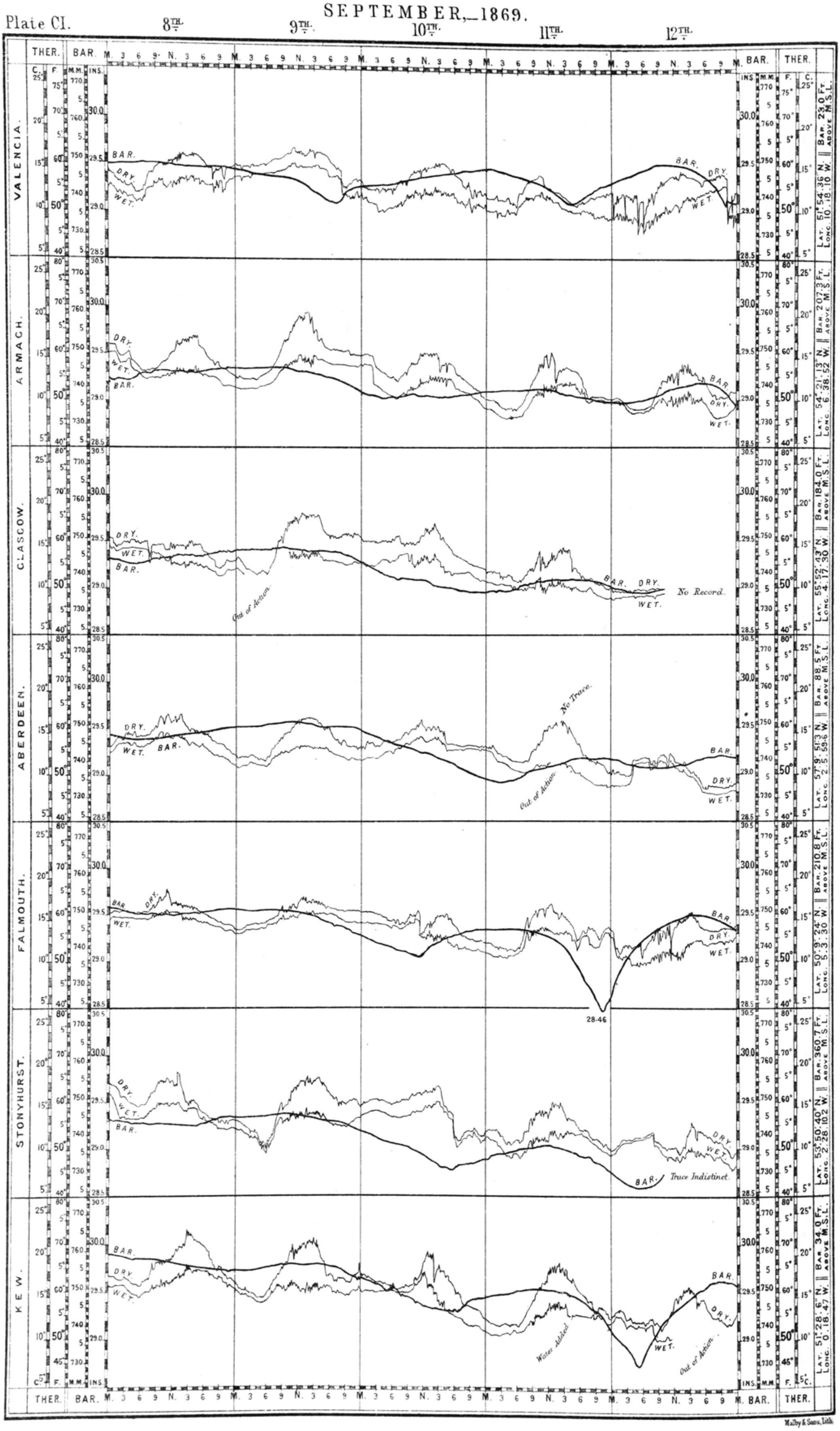
Plate C.



Malby & Sons, Lith.

Plate CI.

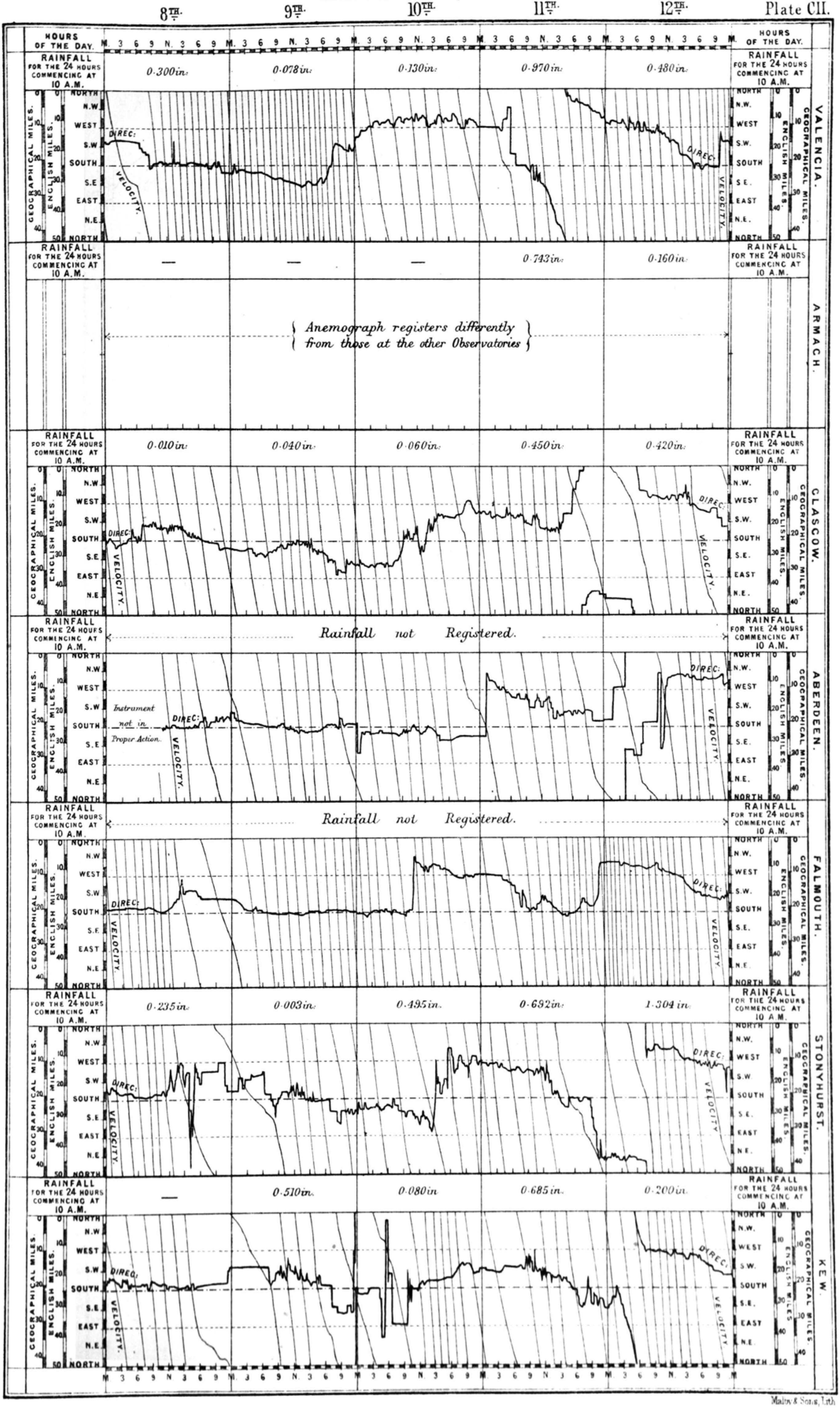
SEPTEMBER,—1869.



Malby & Sons, Lith.

SEPTEMBER, — 1869.

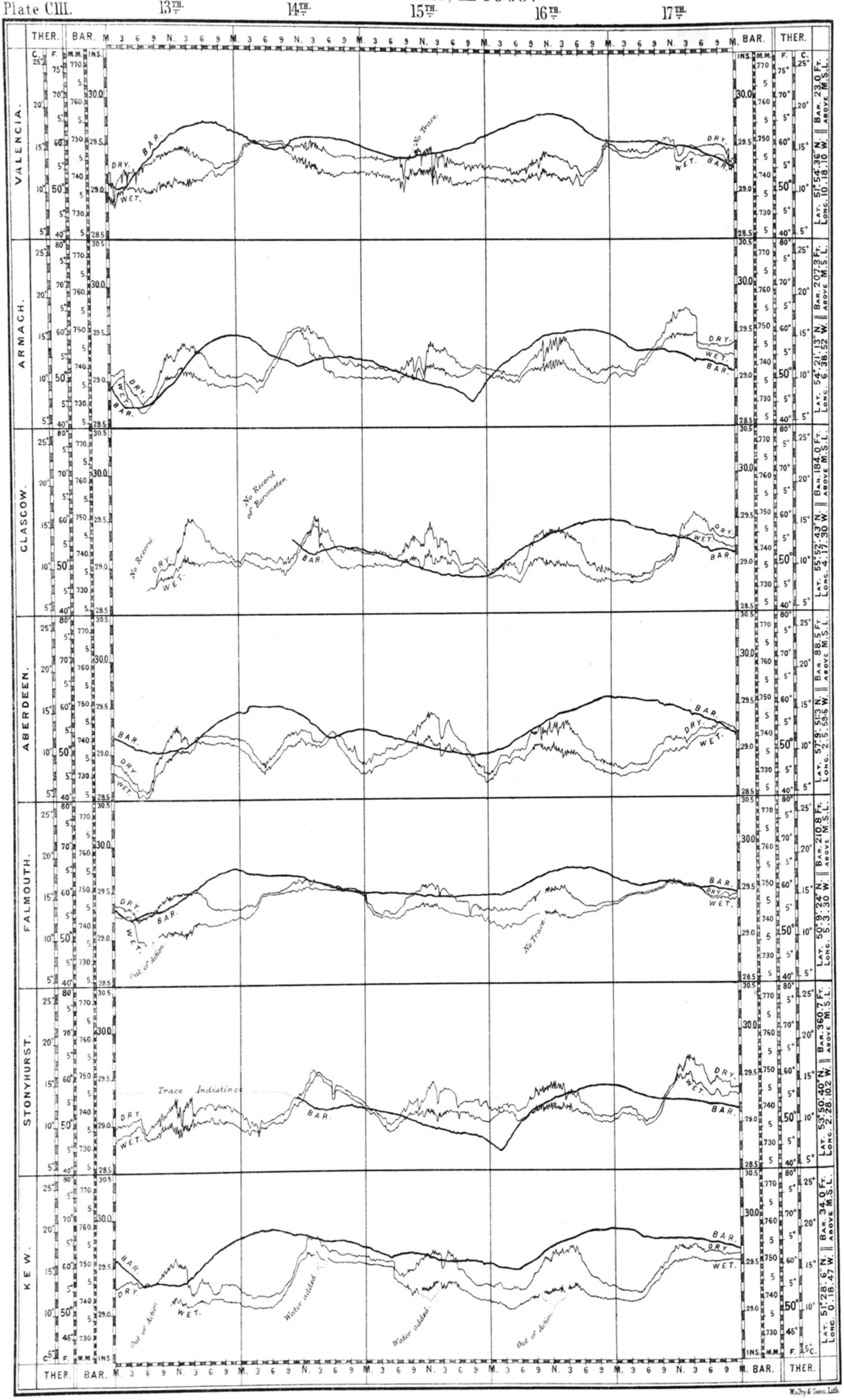
Plate CII.



Malby & Sons, Lith.

SEPTEMBER, — 1869.

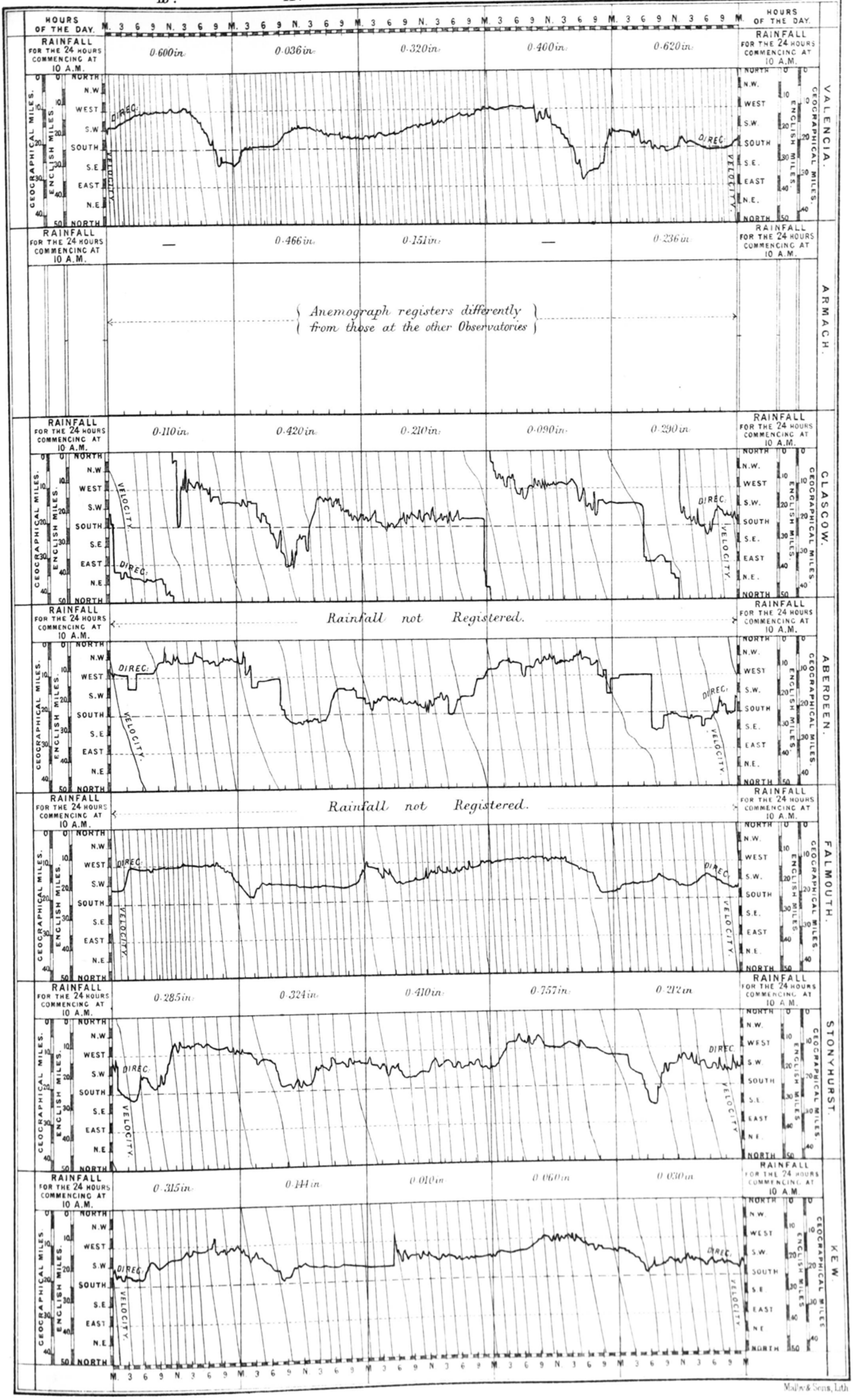
Plate CIII.



Maltby & Sons, Lith.

SEPTEMBER, — 1869.

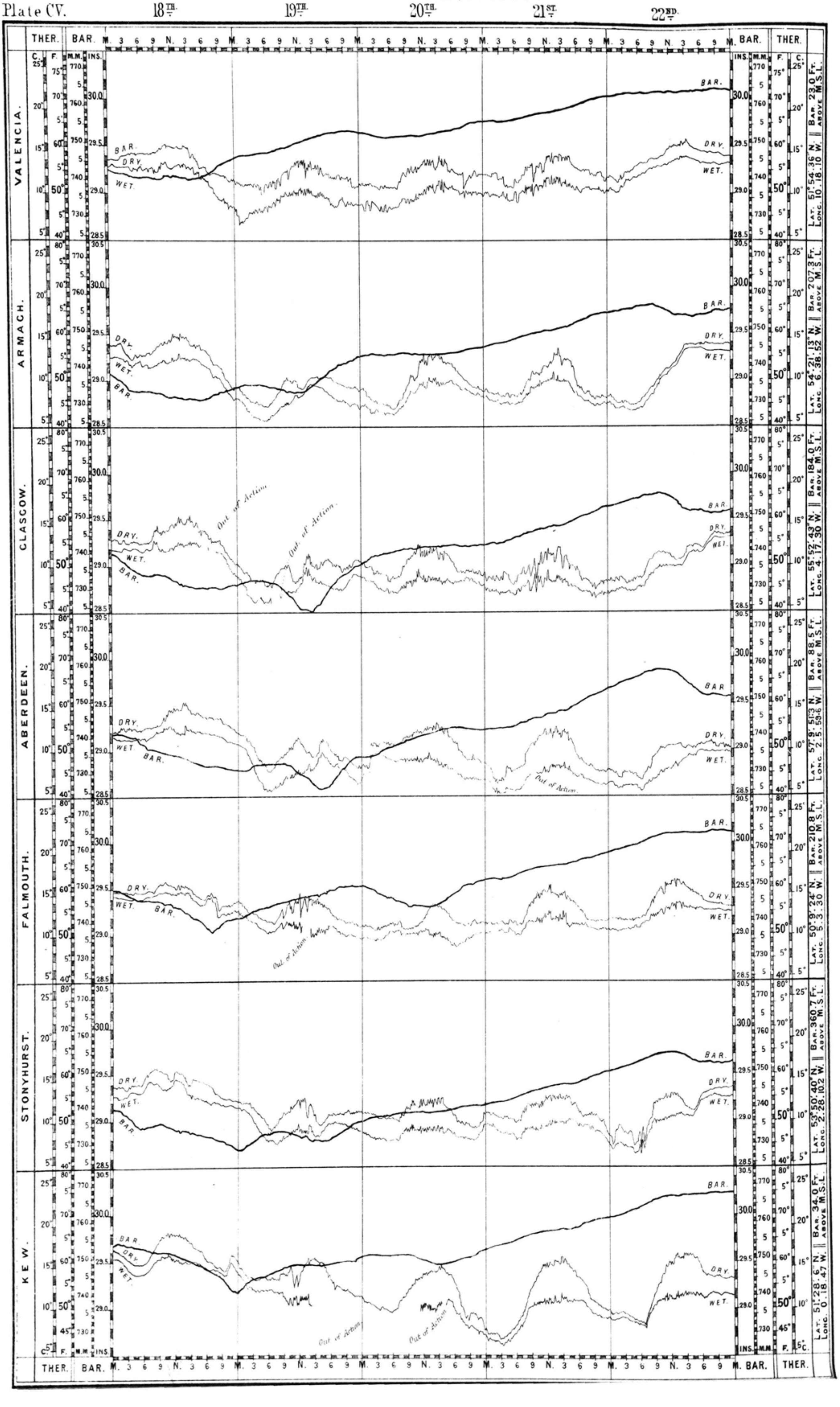
Plate CIV.



Malby & Sons, Lith.

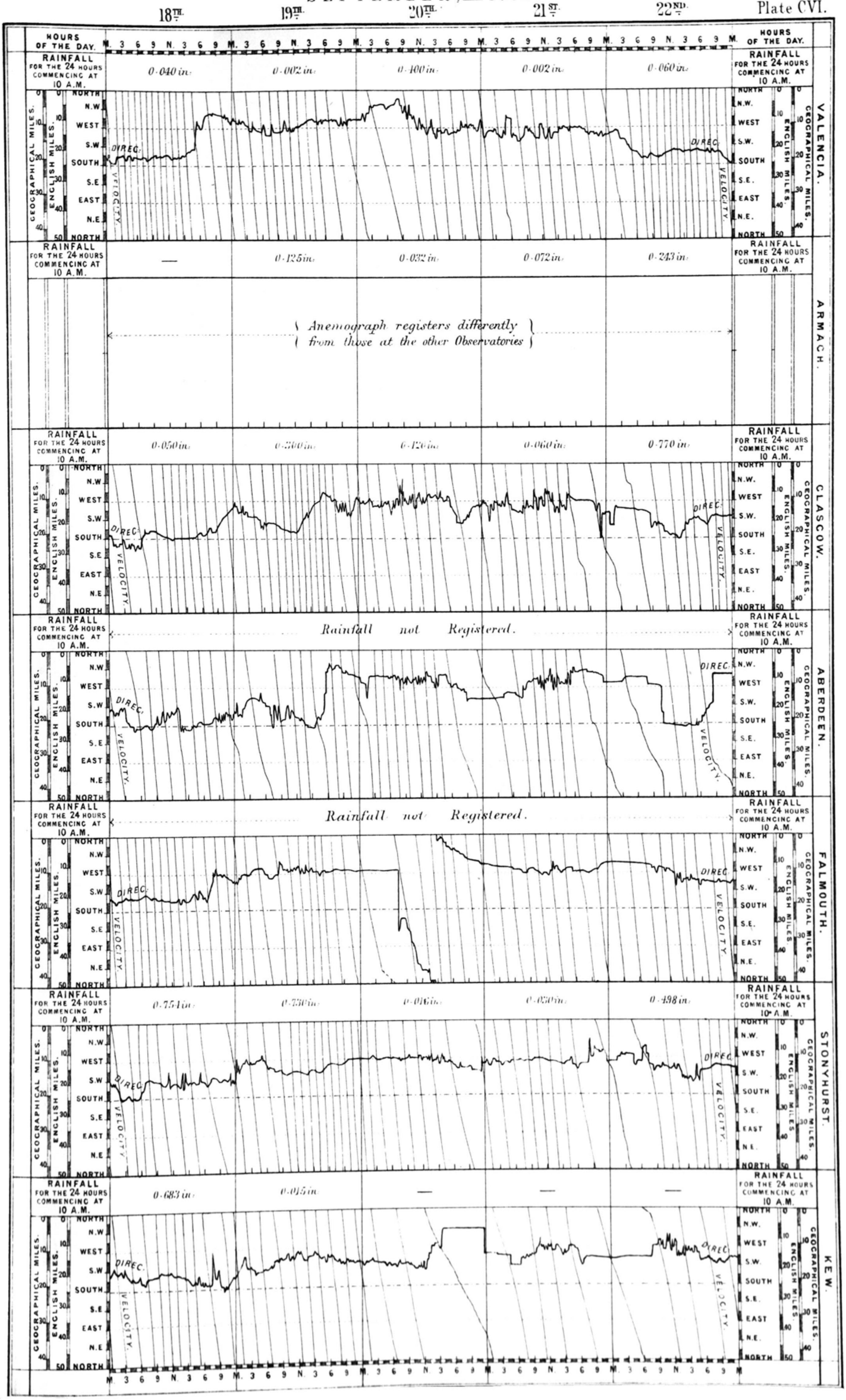
SEPTEMBER, — 1869.

Plate CV.



SEPTEMBER, —1869.

Plate CVI.



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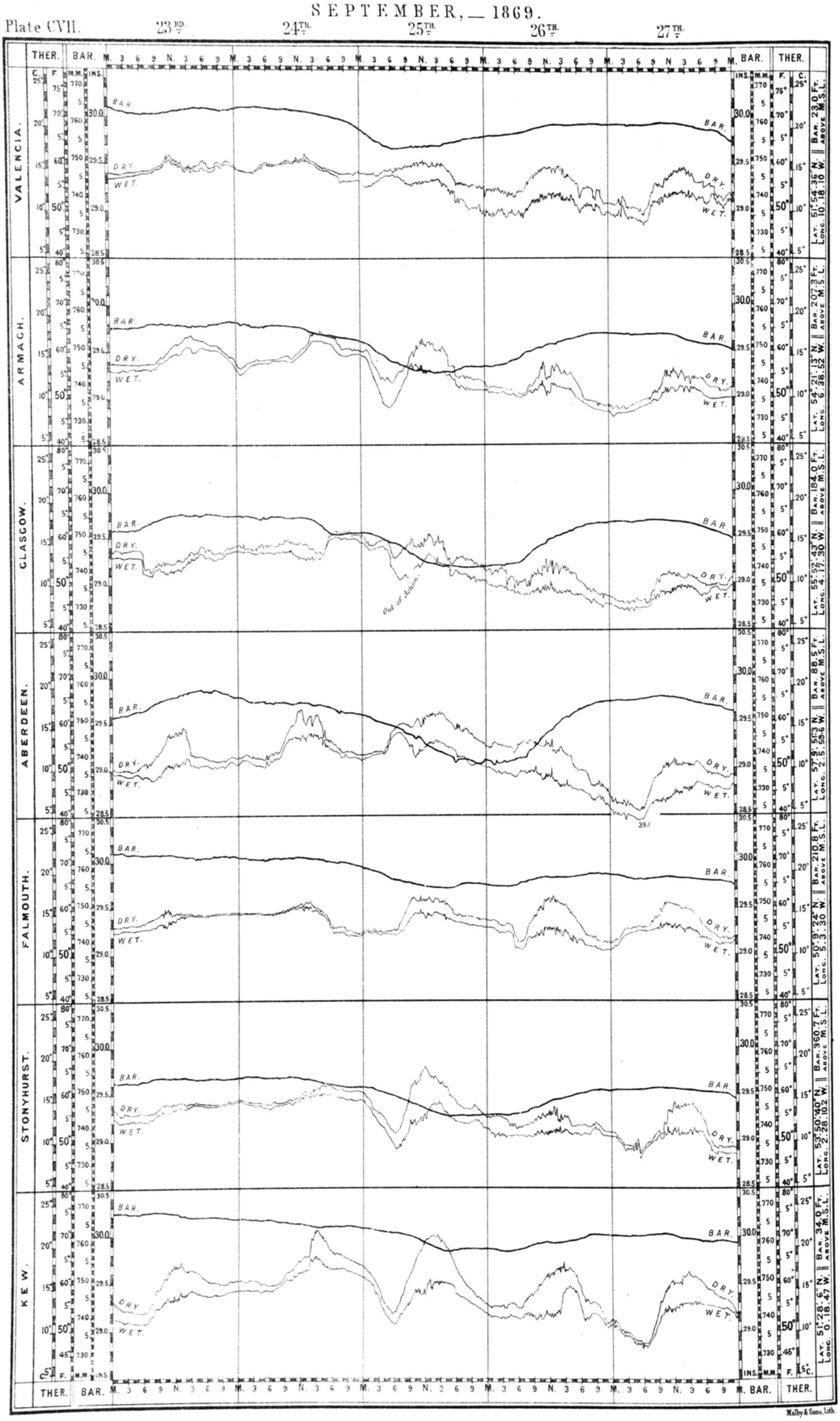
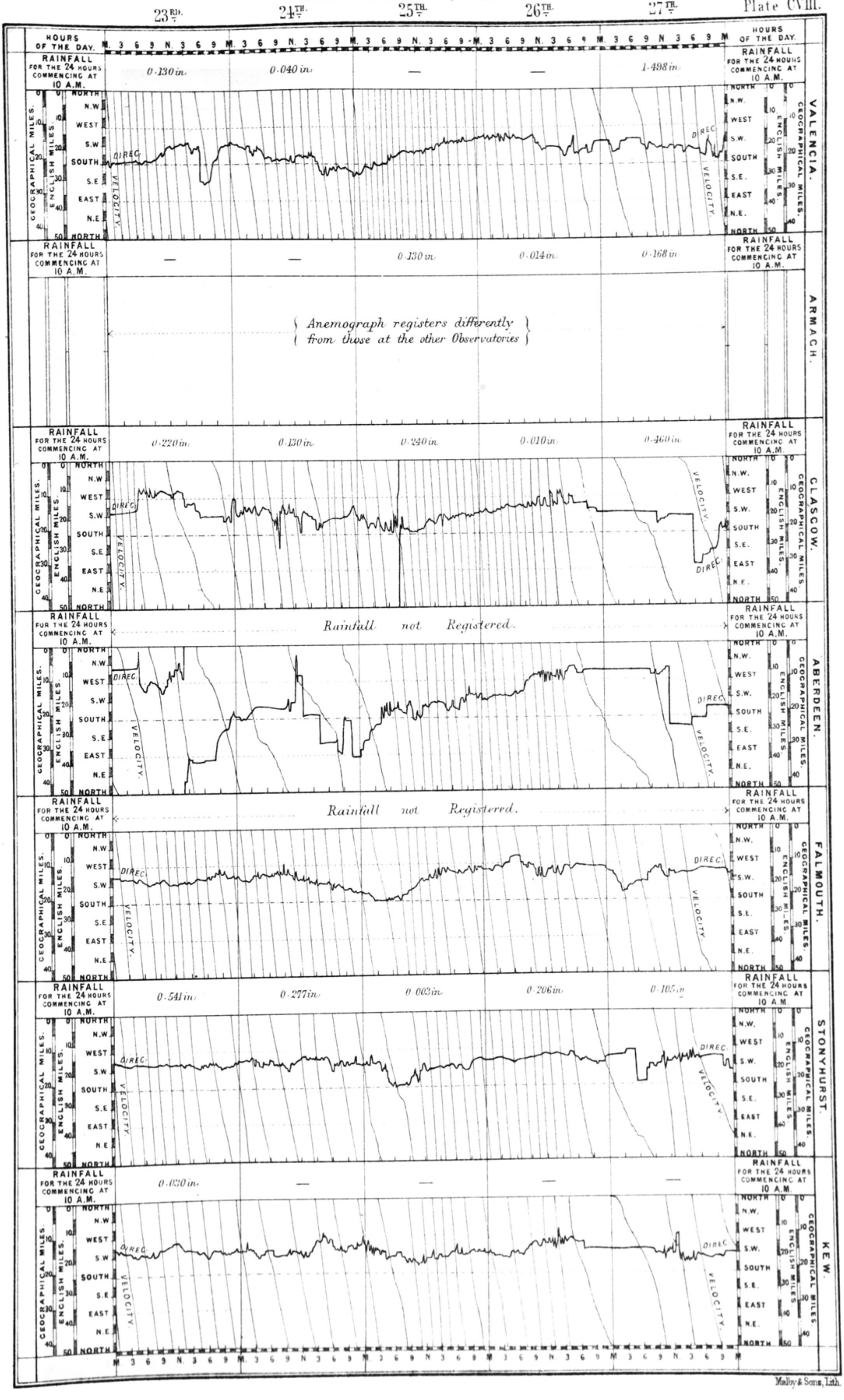


Malby & Sons, Lith.

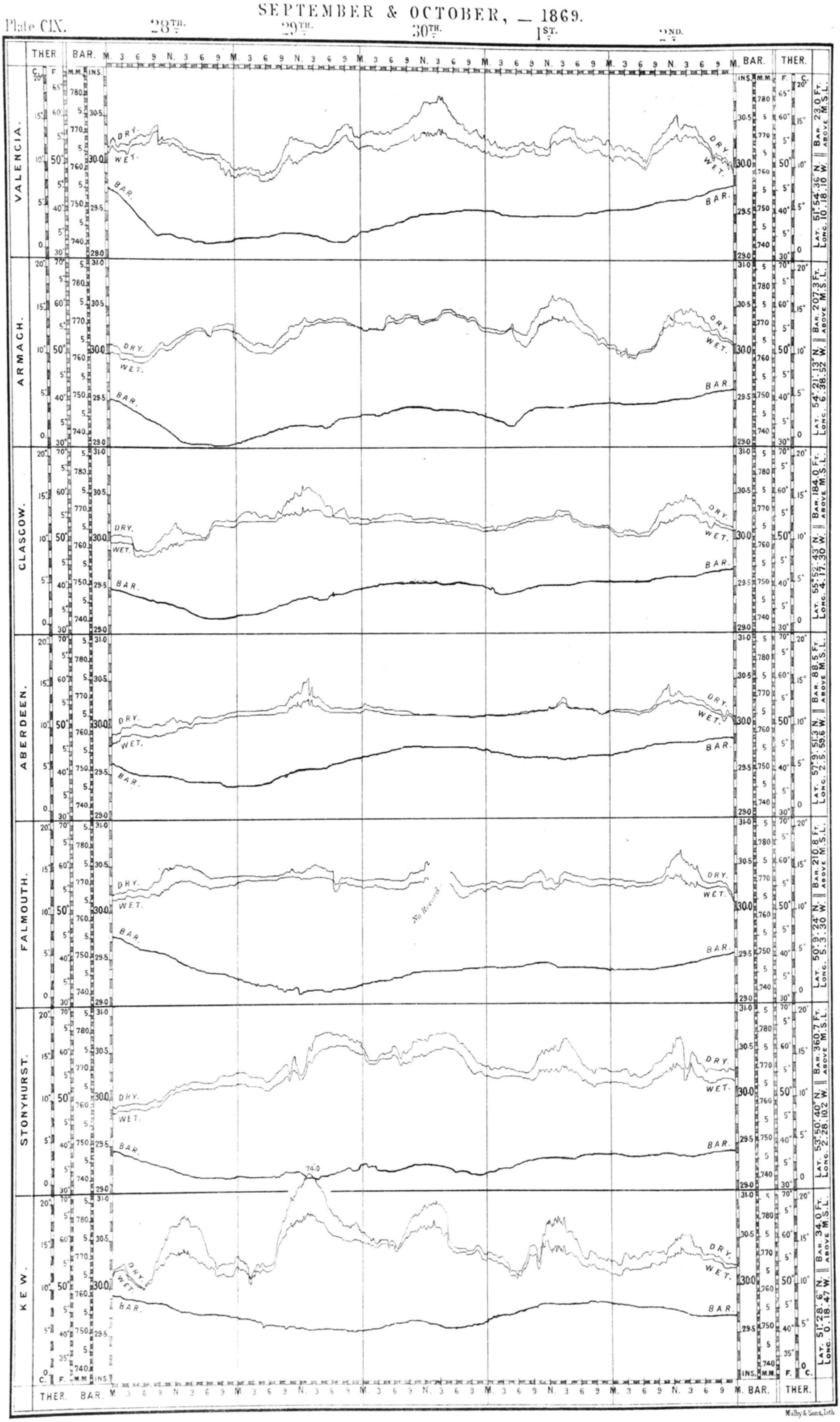
SEPTEMBER,—1869. Plate CVIII.



Malby & Sons, Lith.

Plate CIX.

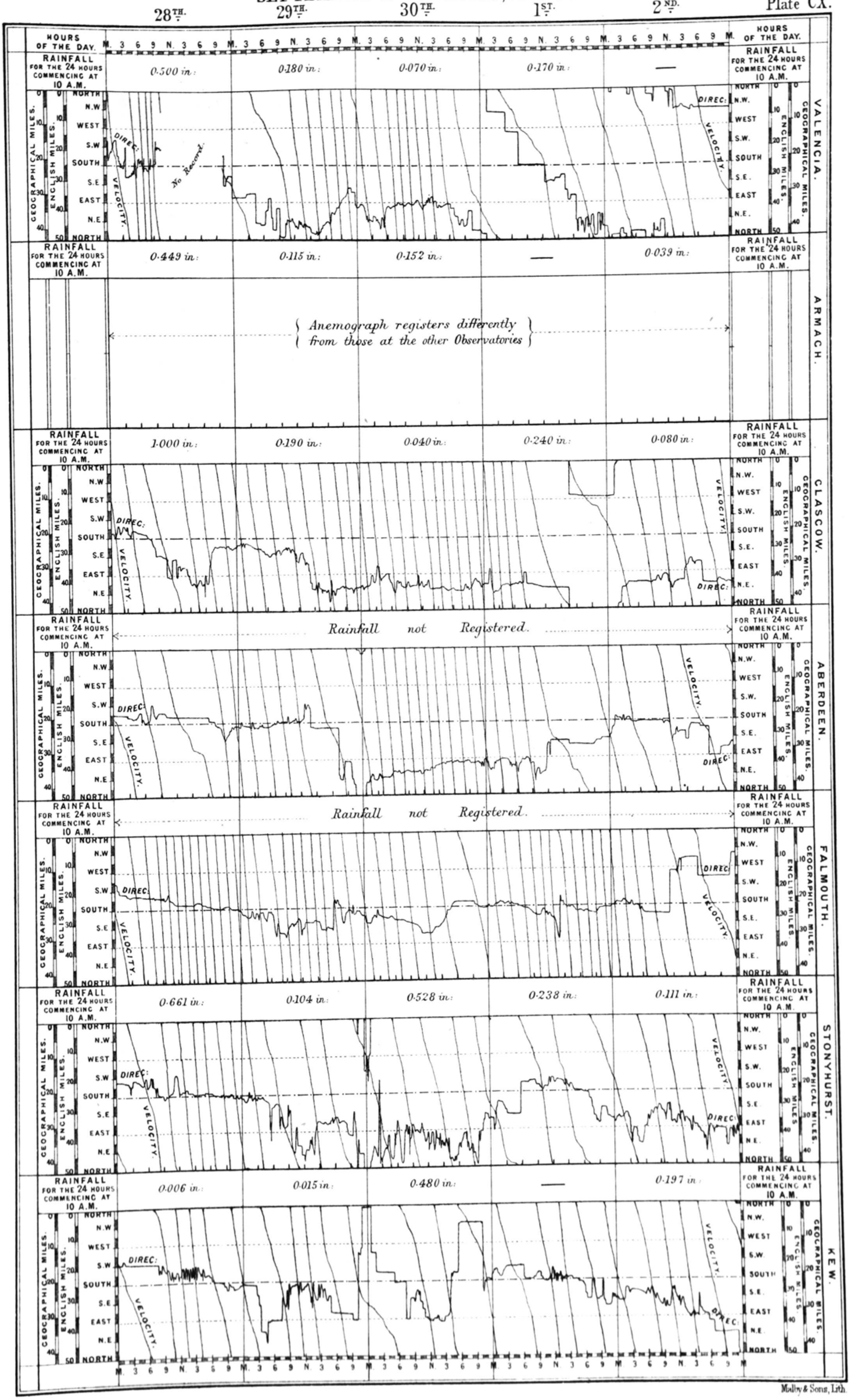
SEPTEMBER & OCTOBER, — 1869.



Malby & Sons, Lith.

SEPTEMBER & OCTOBER, — 1869.

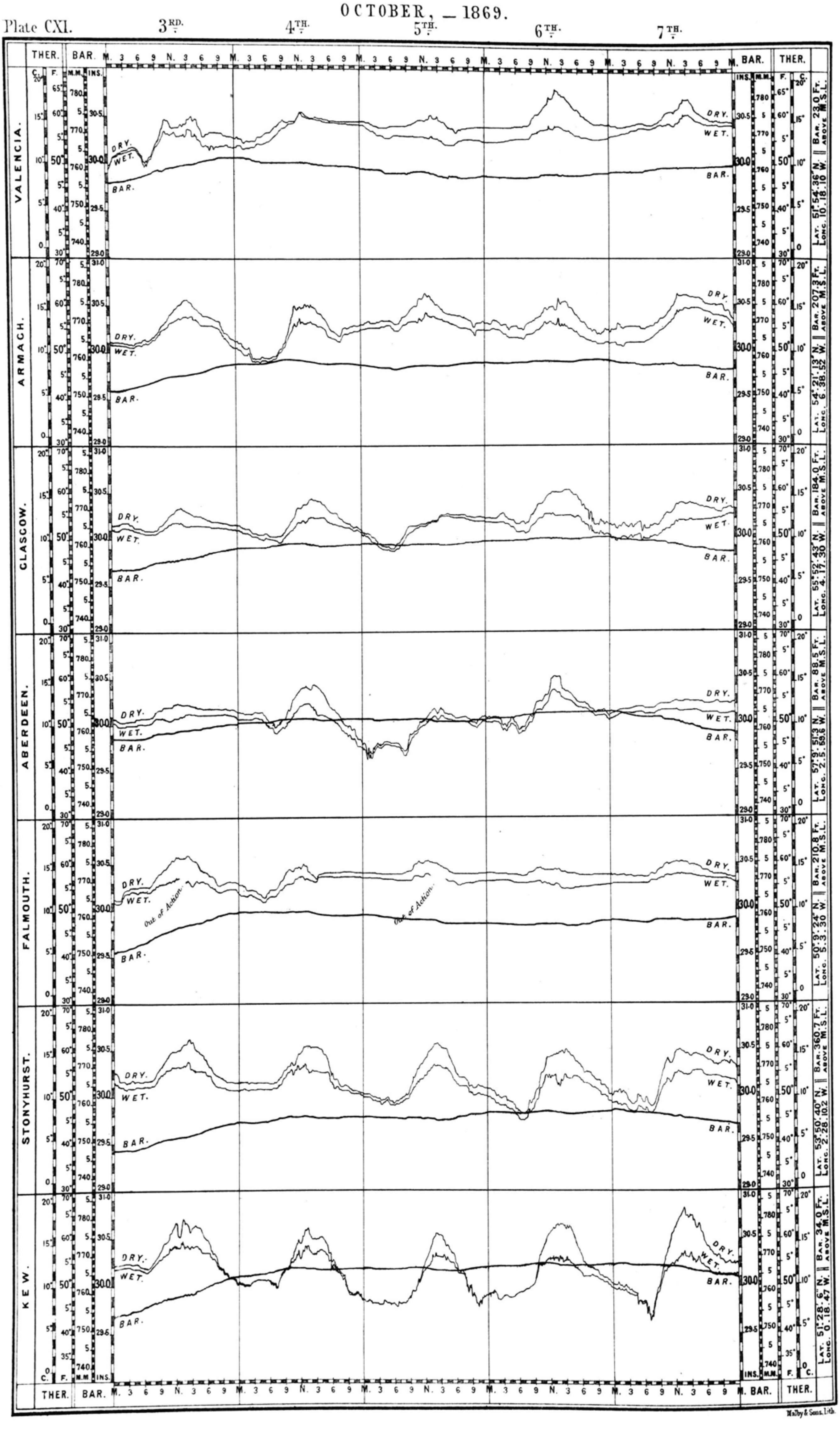
Plate CX.



Malby & Sons, Lith.

Plate CXI.

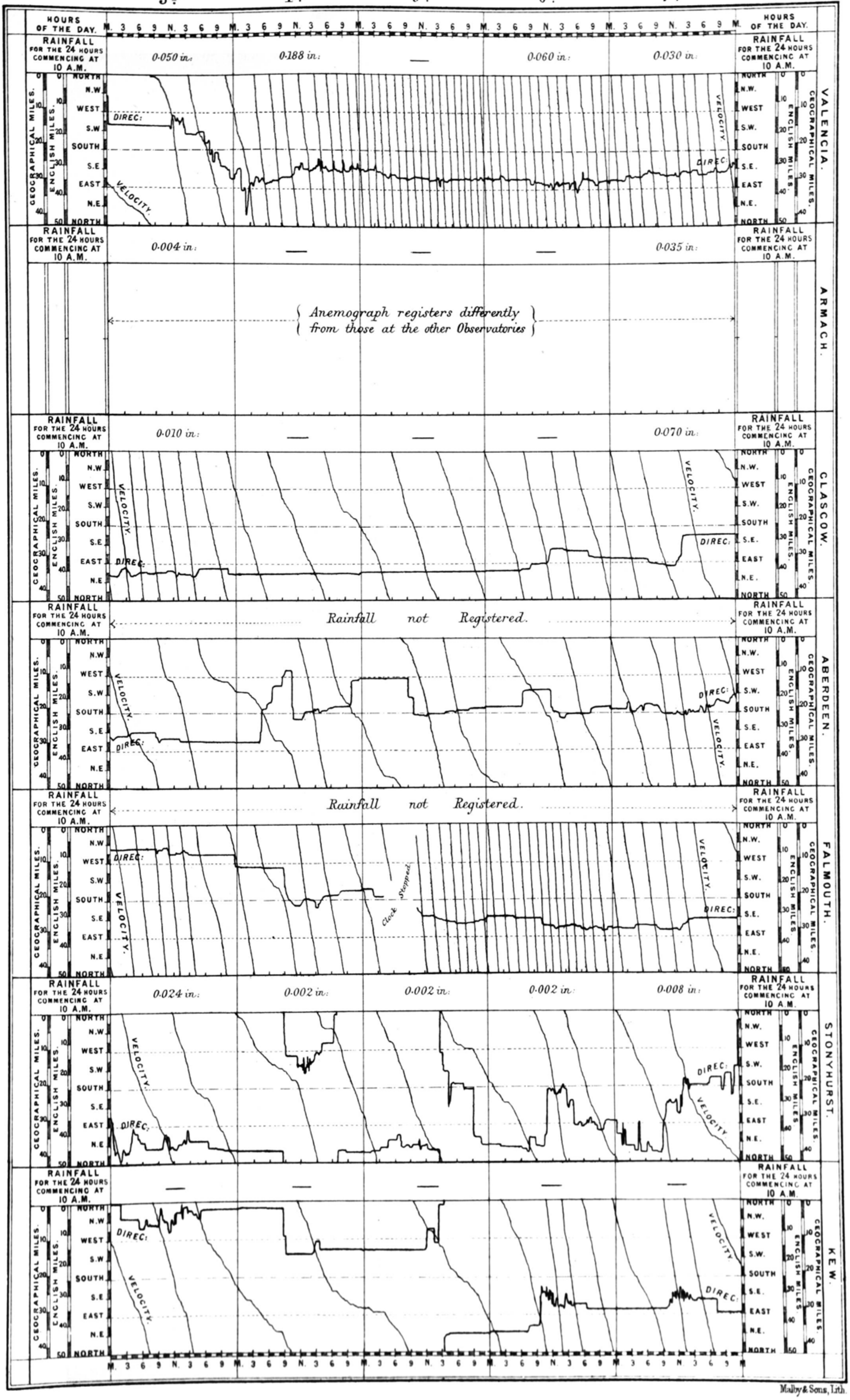
OCTOBER, — 1869.



Maltby & Sons, Lith.

OCTOBER, _1869.

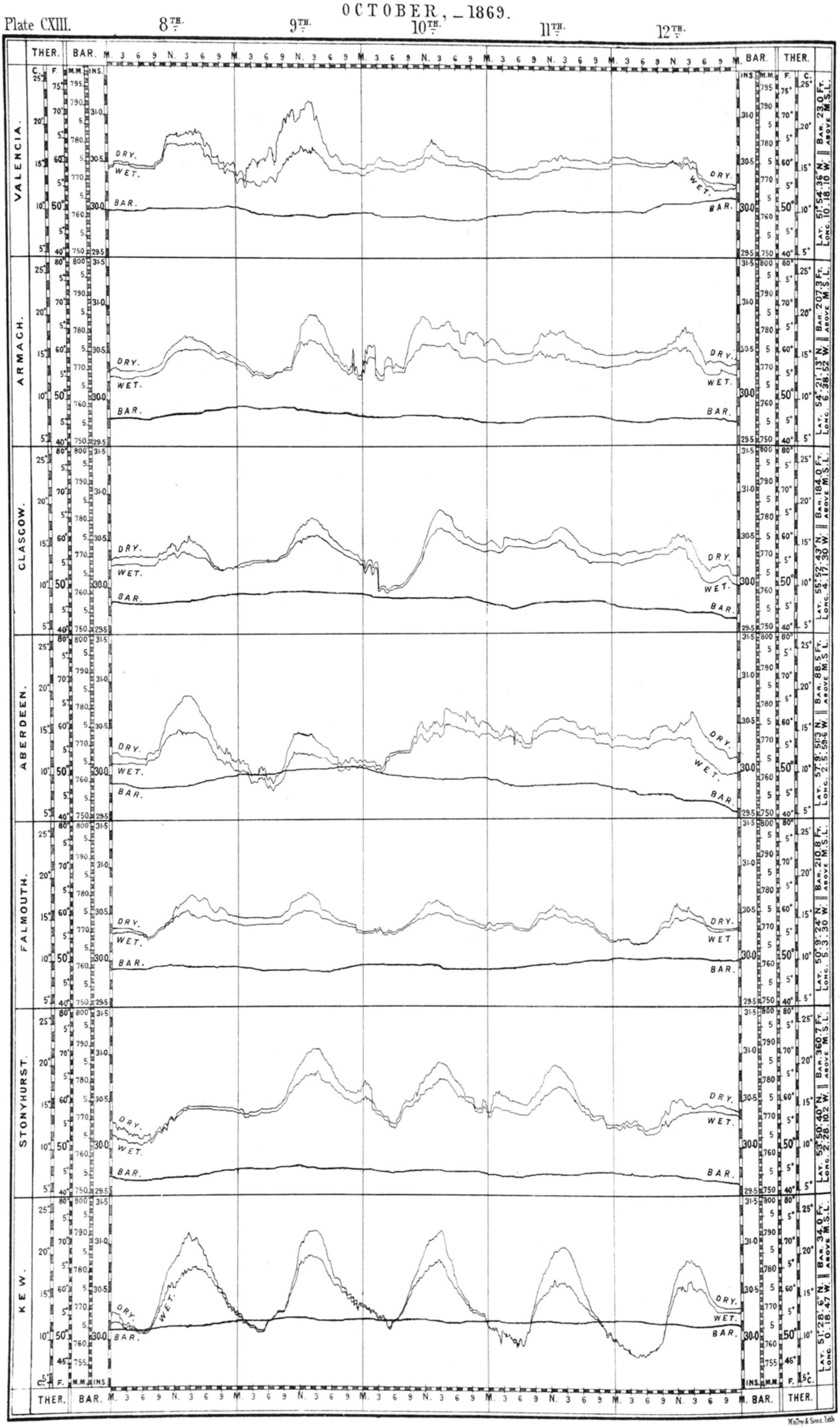
Plate CXII.



Malby & Sons, Lith.

Plate CXIII.

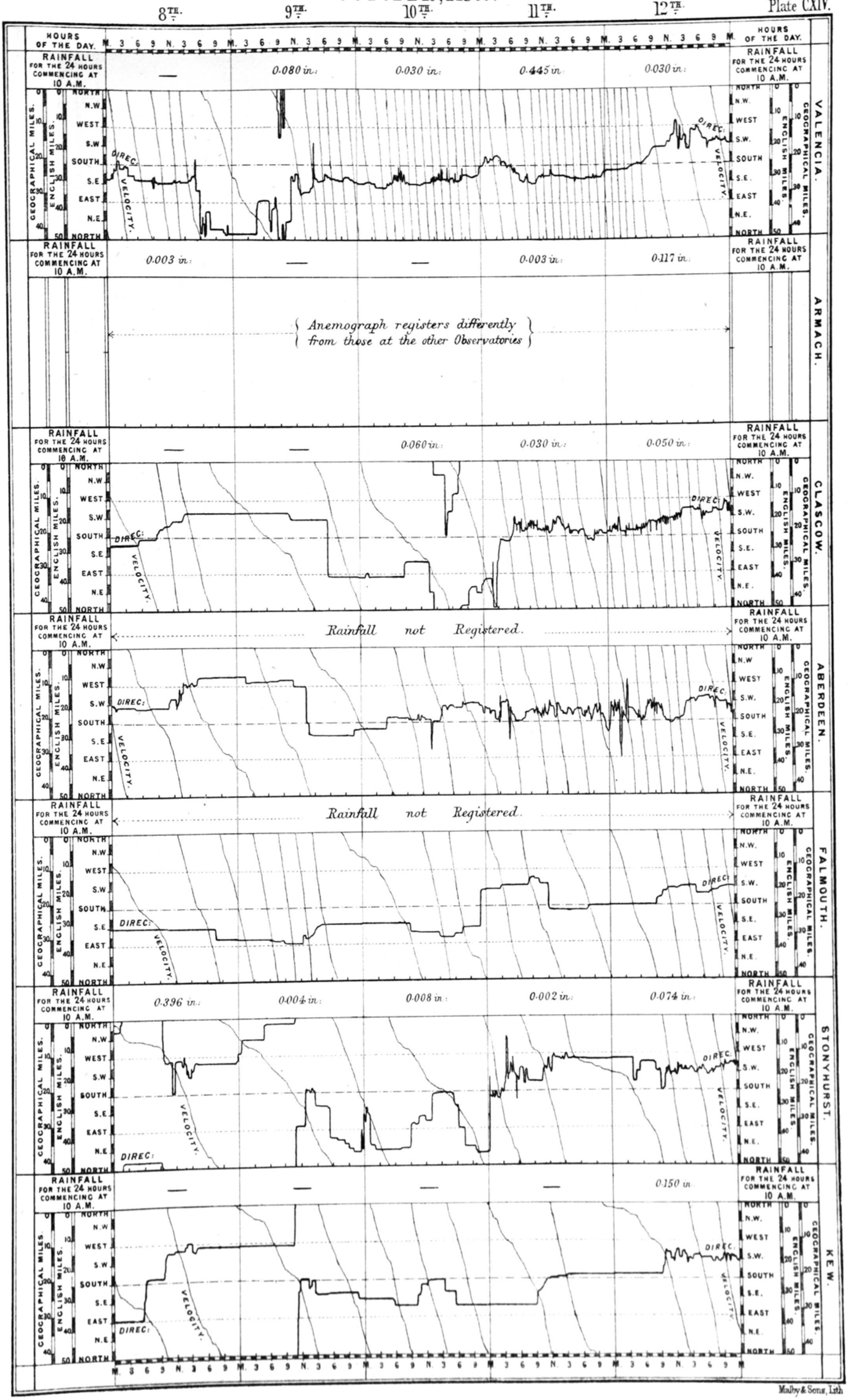
OCTOBER, _1869.



Malby & Sons, lith.

OCTOBER, 1869.

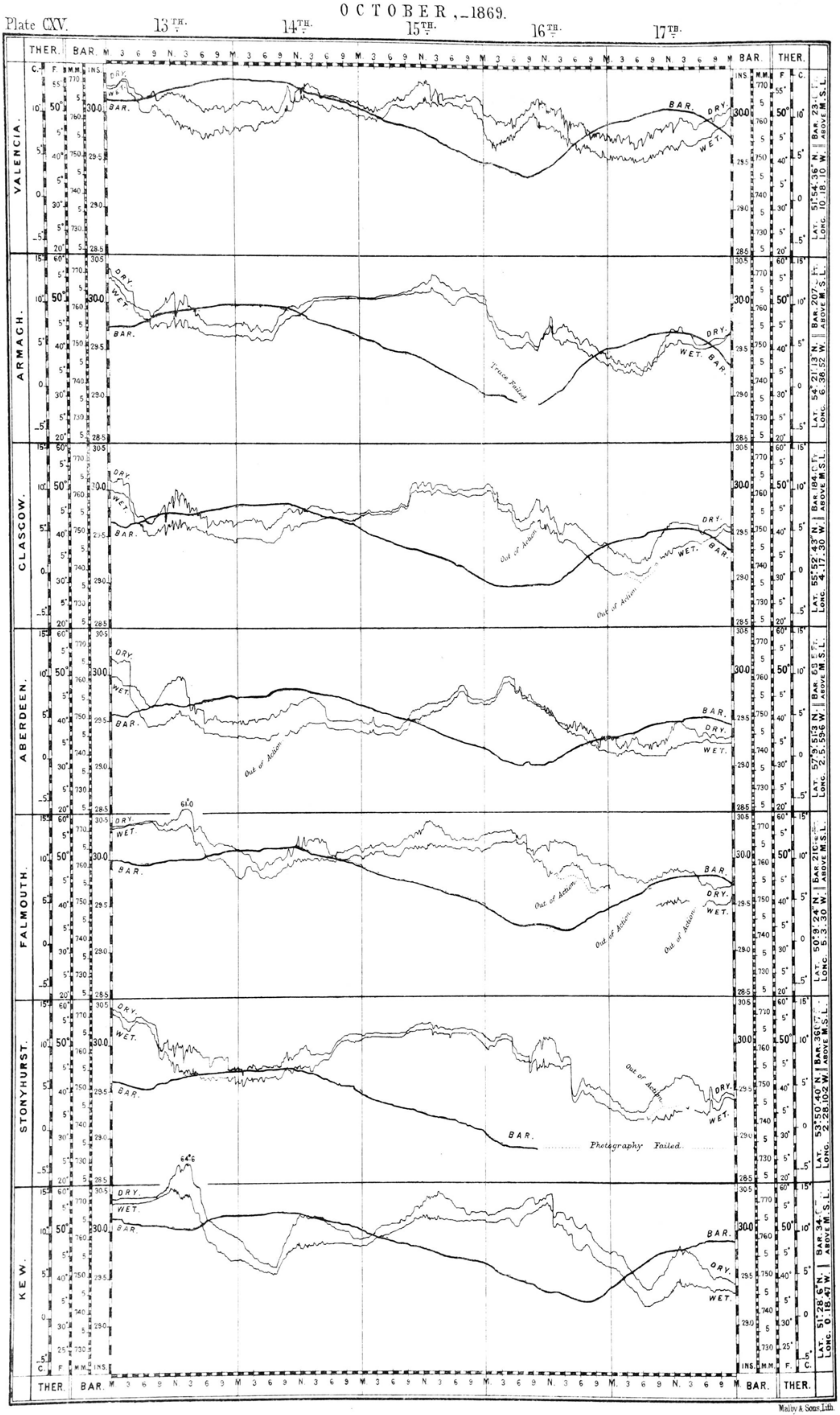
Plate CXIV.



Malby & Sons, Lith.

Plate CXV.

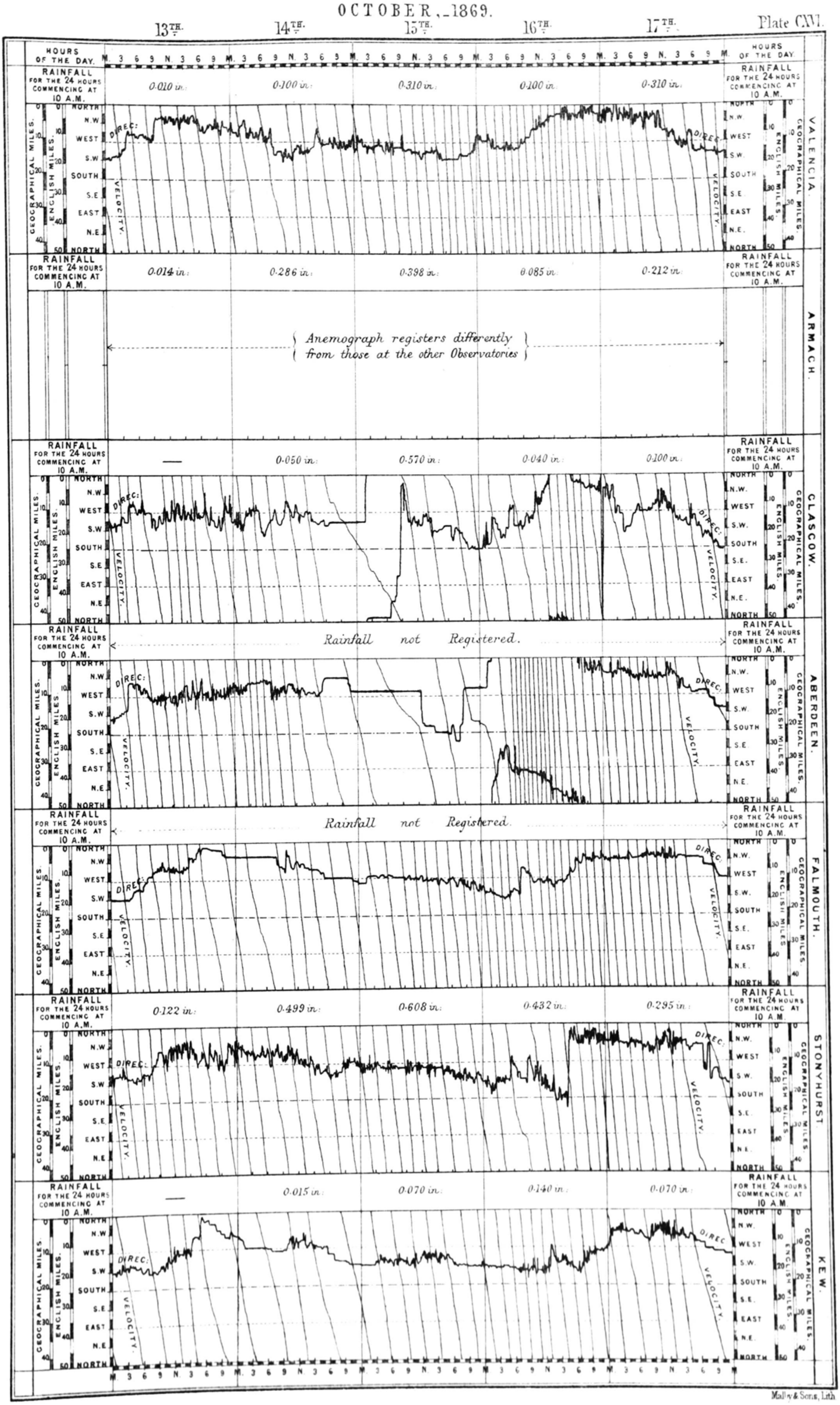
OCTOBER, _1869.



Malby & Sons, Lith.

OCTOBER, 1869.

Plate CXVI.

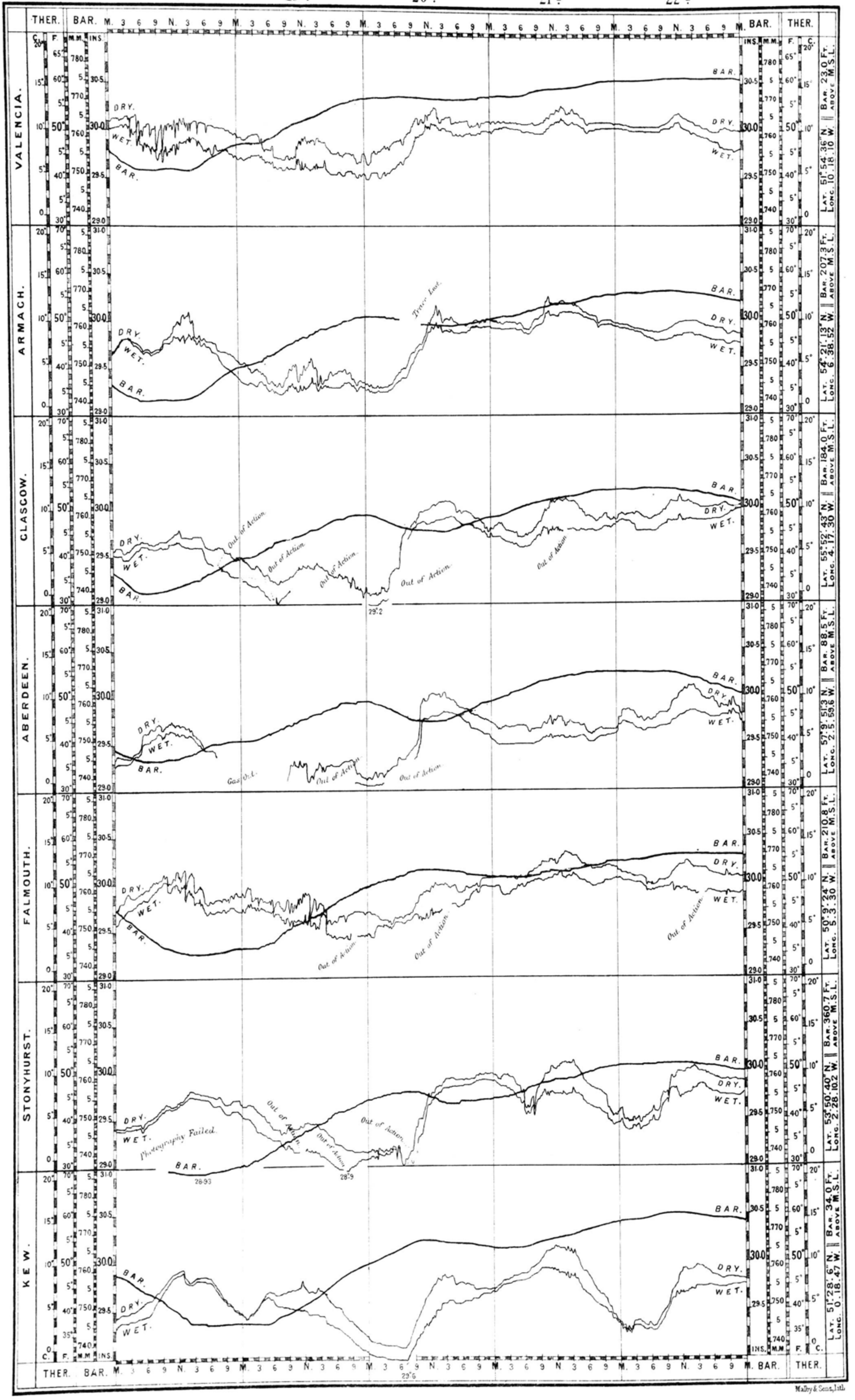


Malby & Sons, Lith.

Plate CXVII.

OCTOBER, — 1869.

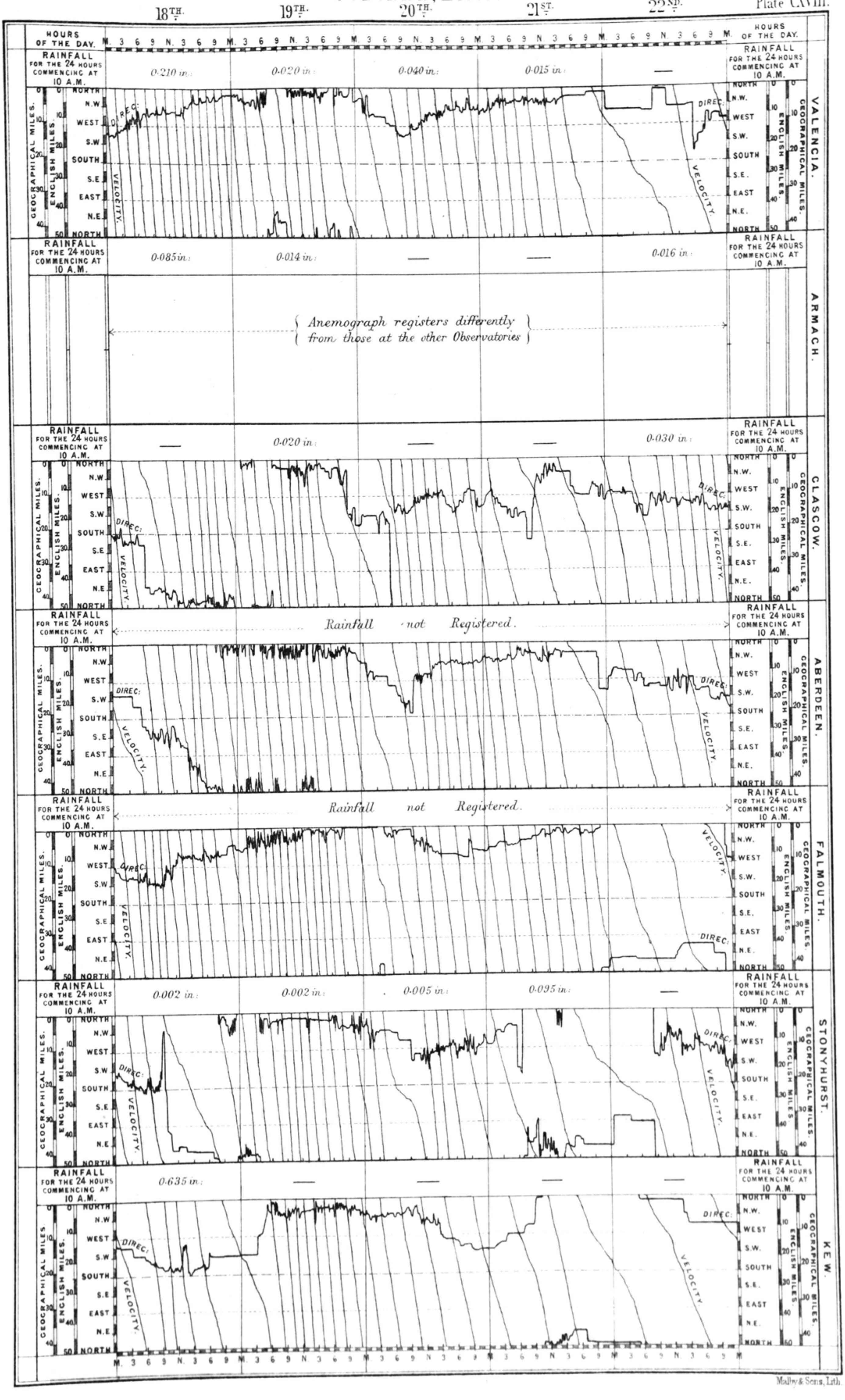
18TH. 19TH. 20TH. 21ST. 22ND.



Malby & Sons, Lith.

OCTOBER, — 1869.

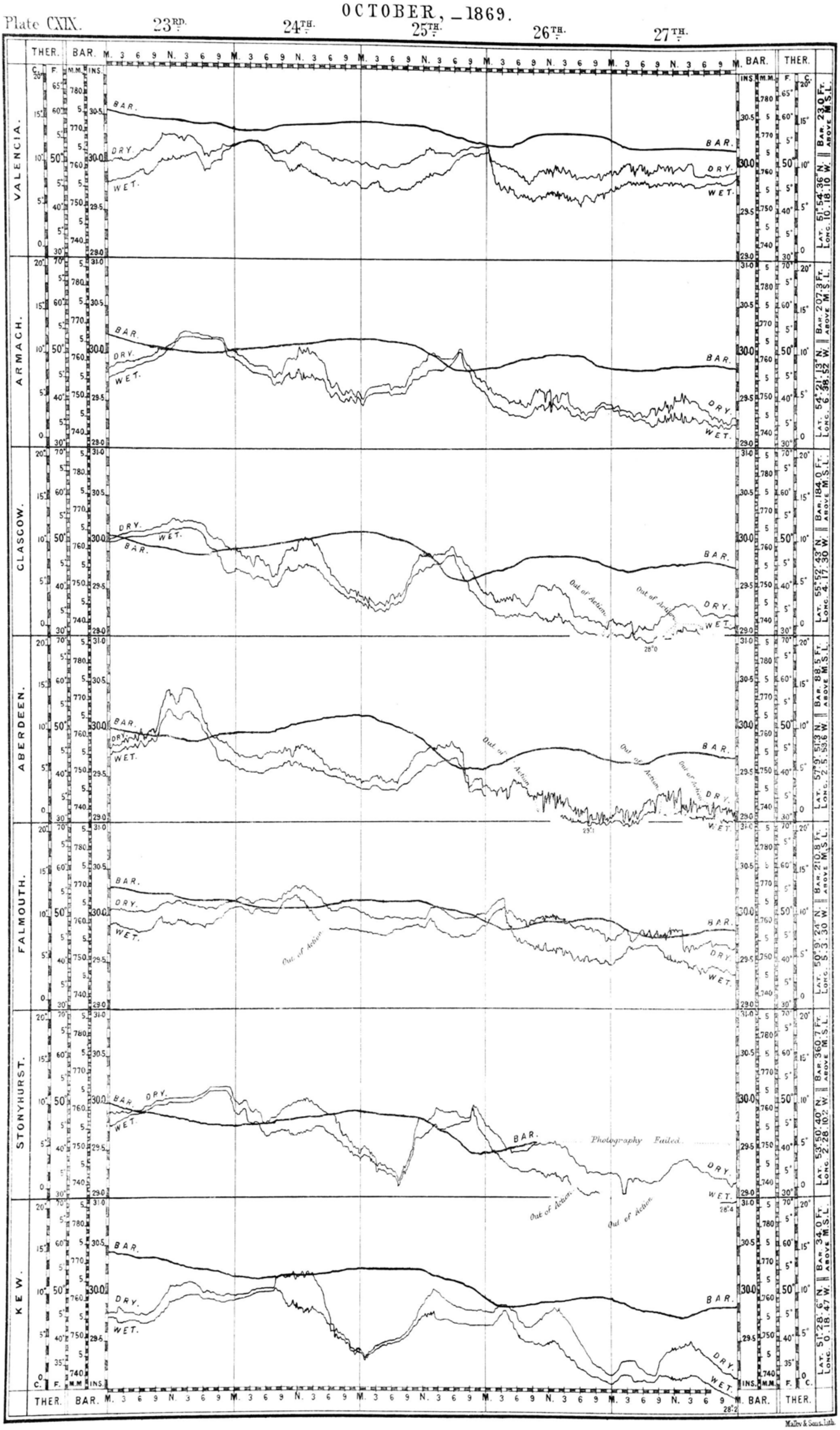
Plate CXVIII.



Maltby & Sons, Lith.

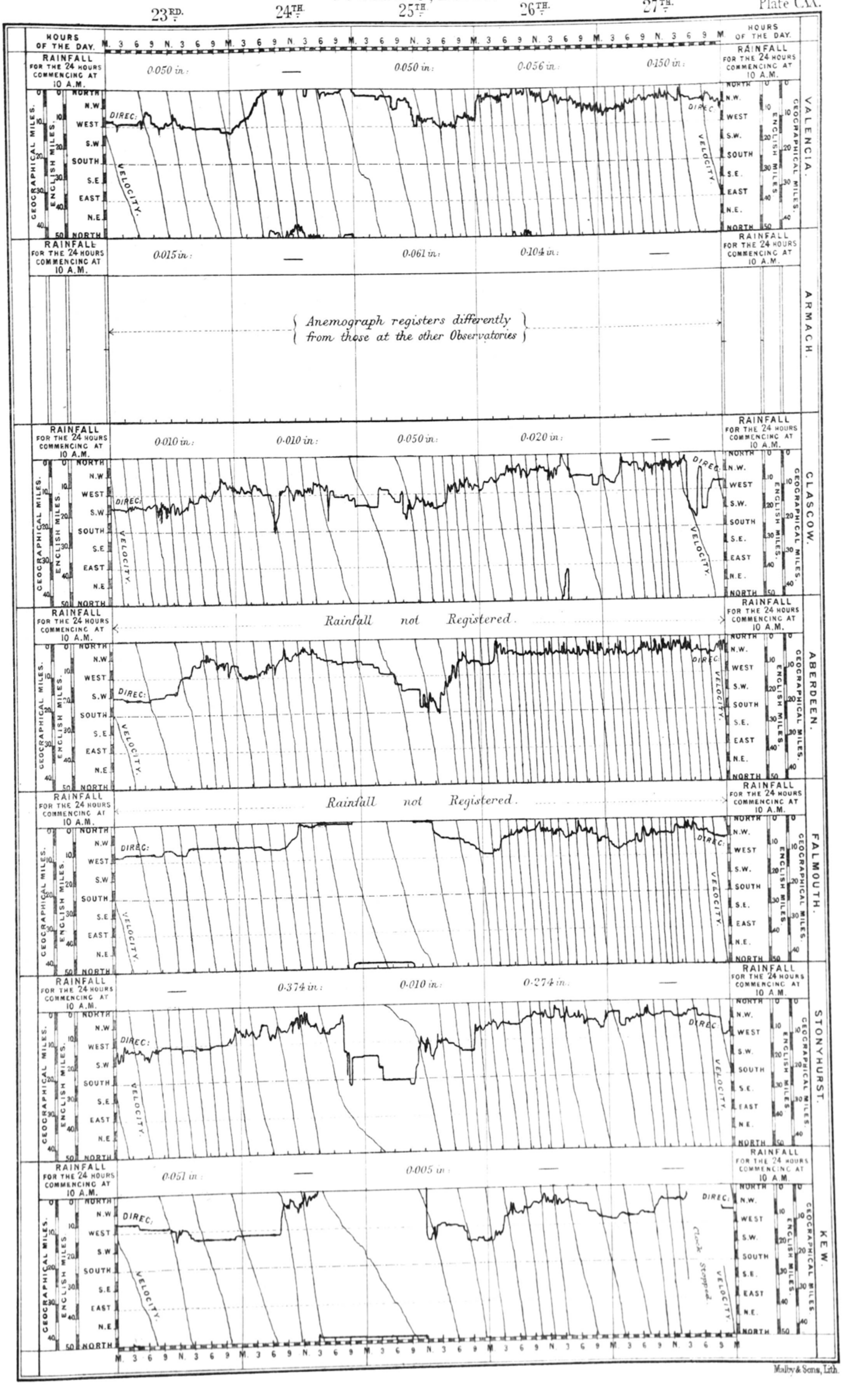
Plate CXIX.

OCTOBER, _1869.



Malby & Sons, Lith.

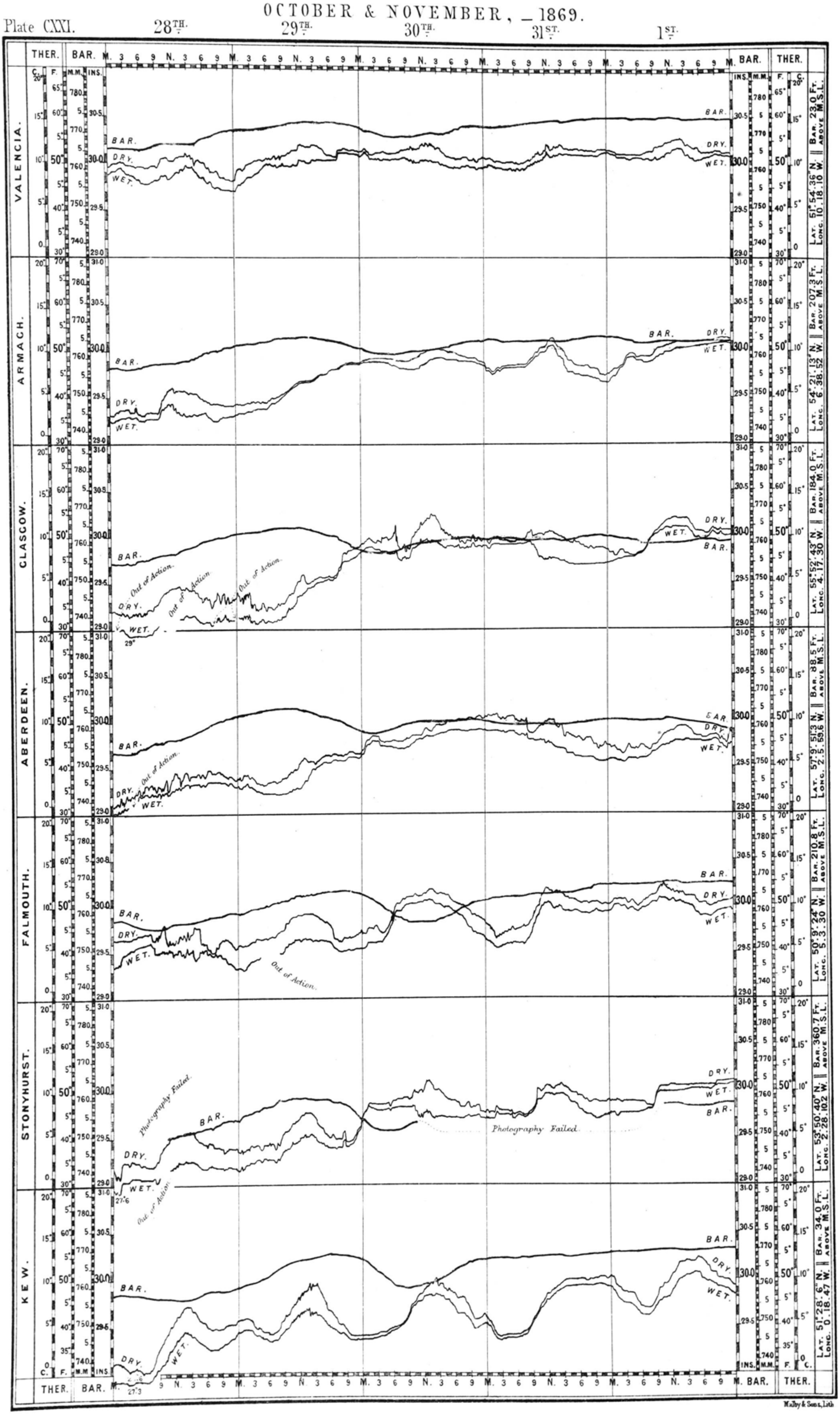
OCTOBER, _1869.



Malby & Sons, Lith.

Plate CXXI.

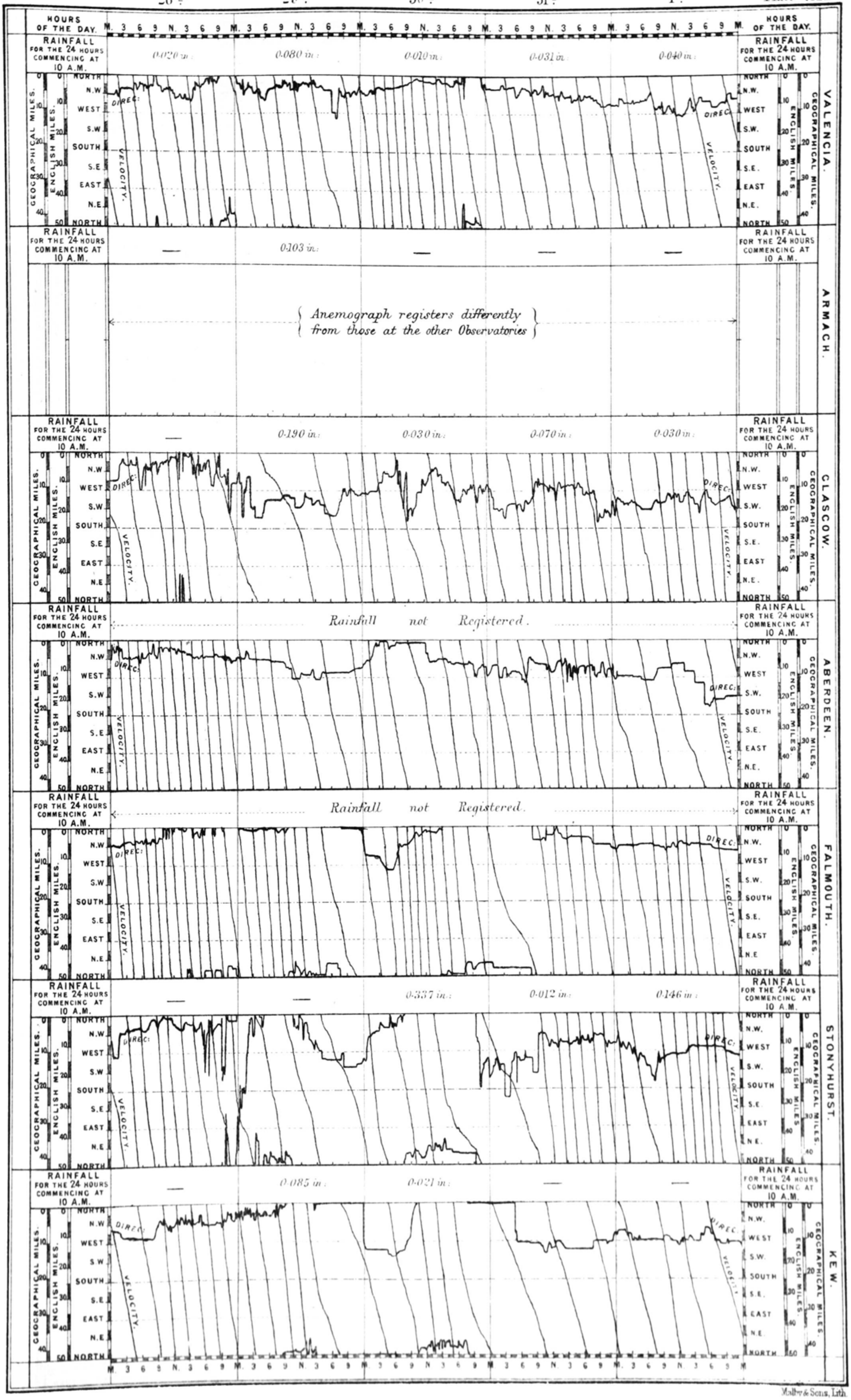
OCTOBER & NOVEMBER, _ 1869.



Malby & Sons, Lith.

OCTOBER & NOVEMBER, — 1869.

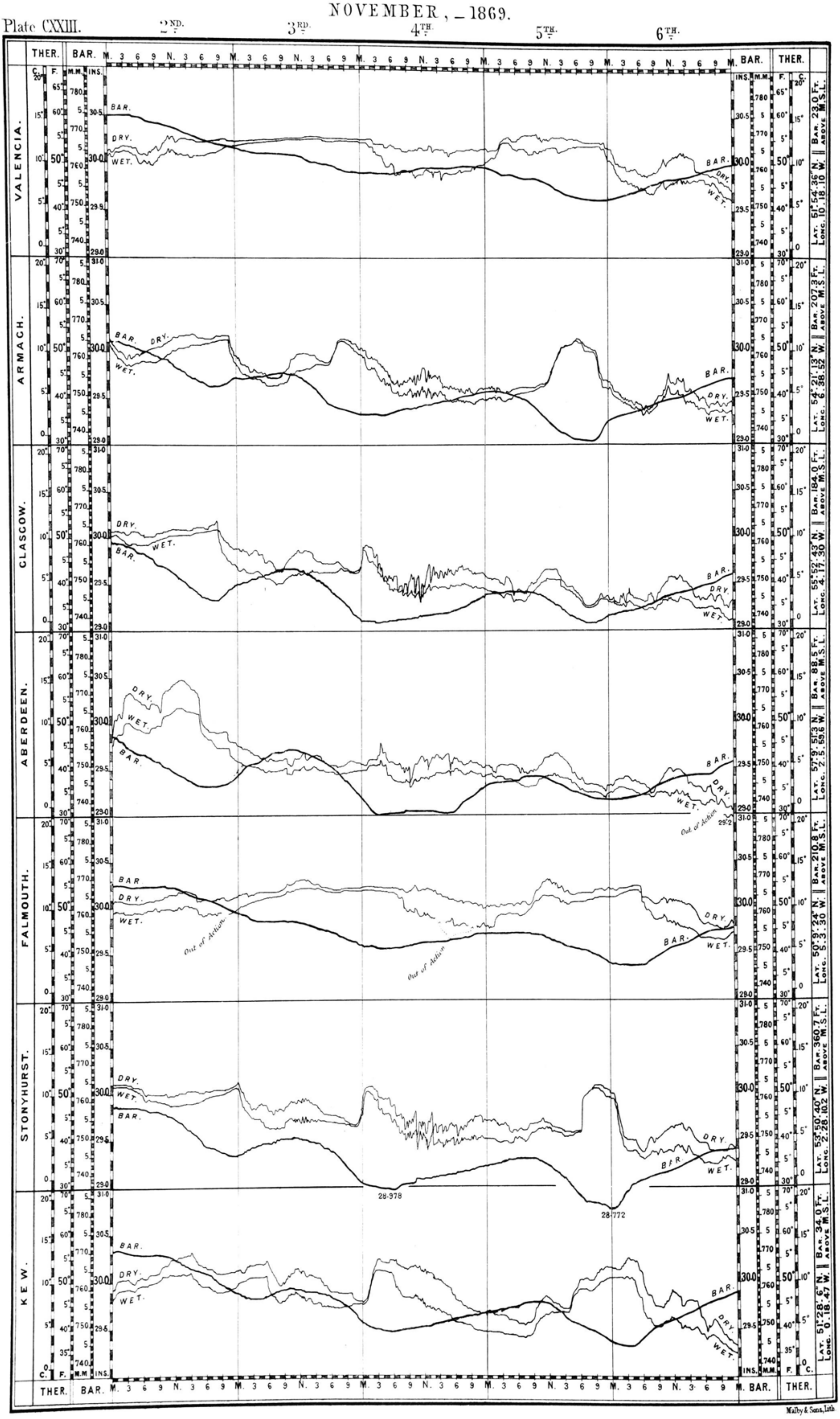
28TH. 29TH. 30TH. 31ST. 1ST. Plate CXXII.



Maltby & Sons, Lith.

Plate CXXIII.

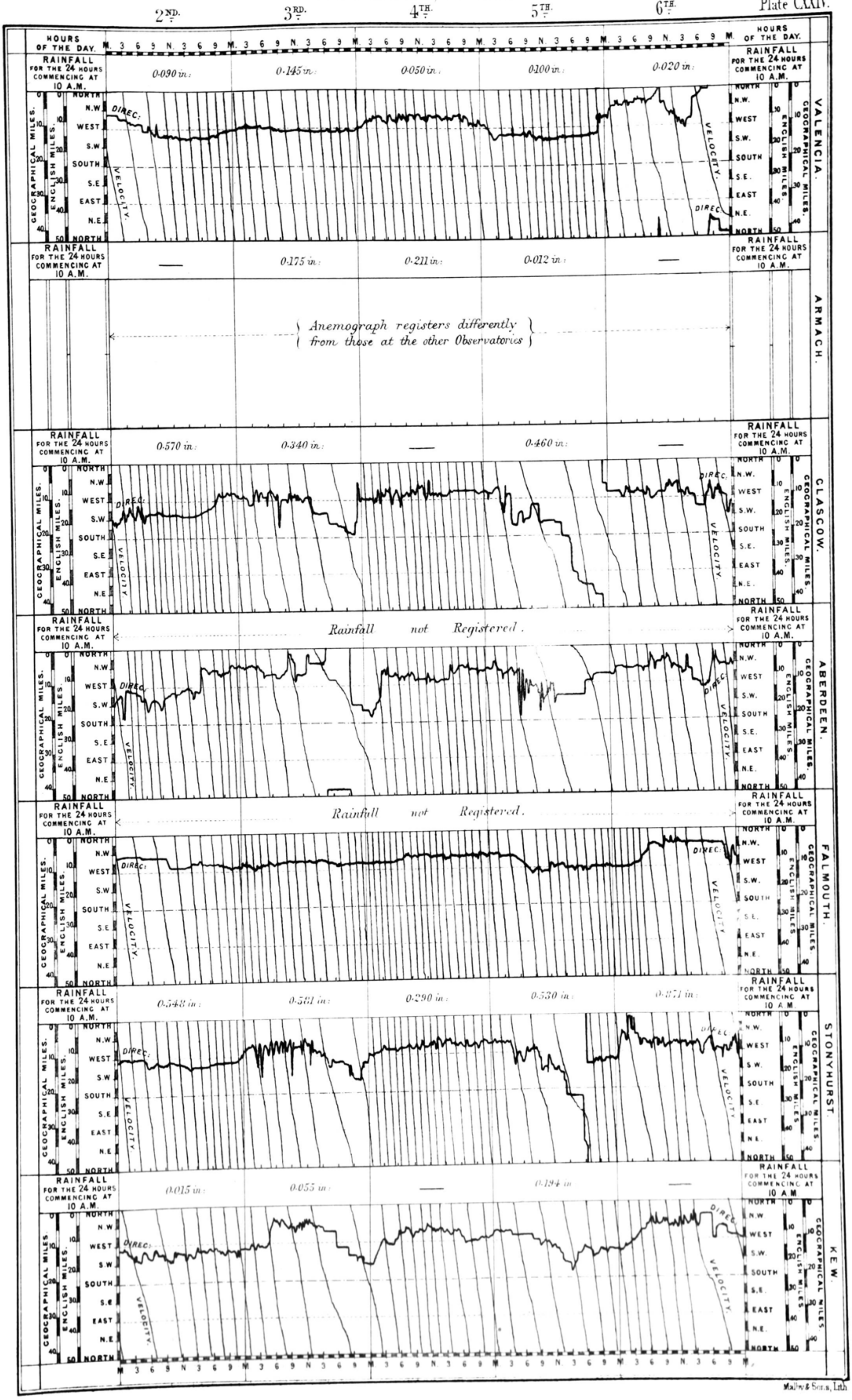
NOVEMBER, _ 1869.



Malby & Sons, Lith.

NOVEMBER, — 1869.

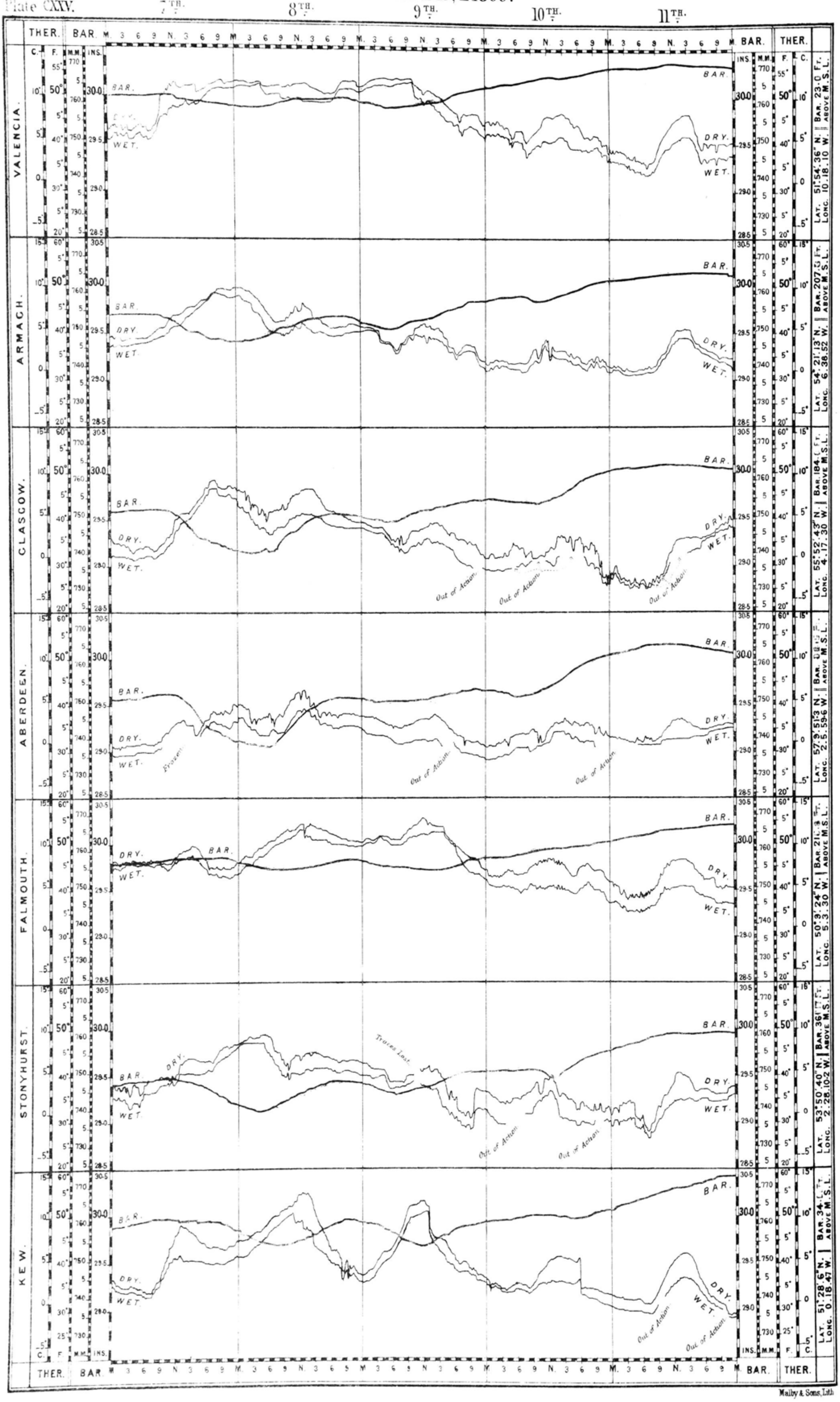
Plate CXXIV.



Malby & Sons, Lith.

Plate CXXV.

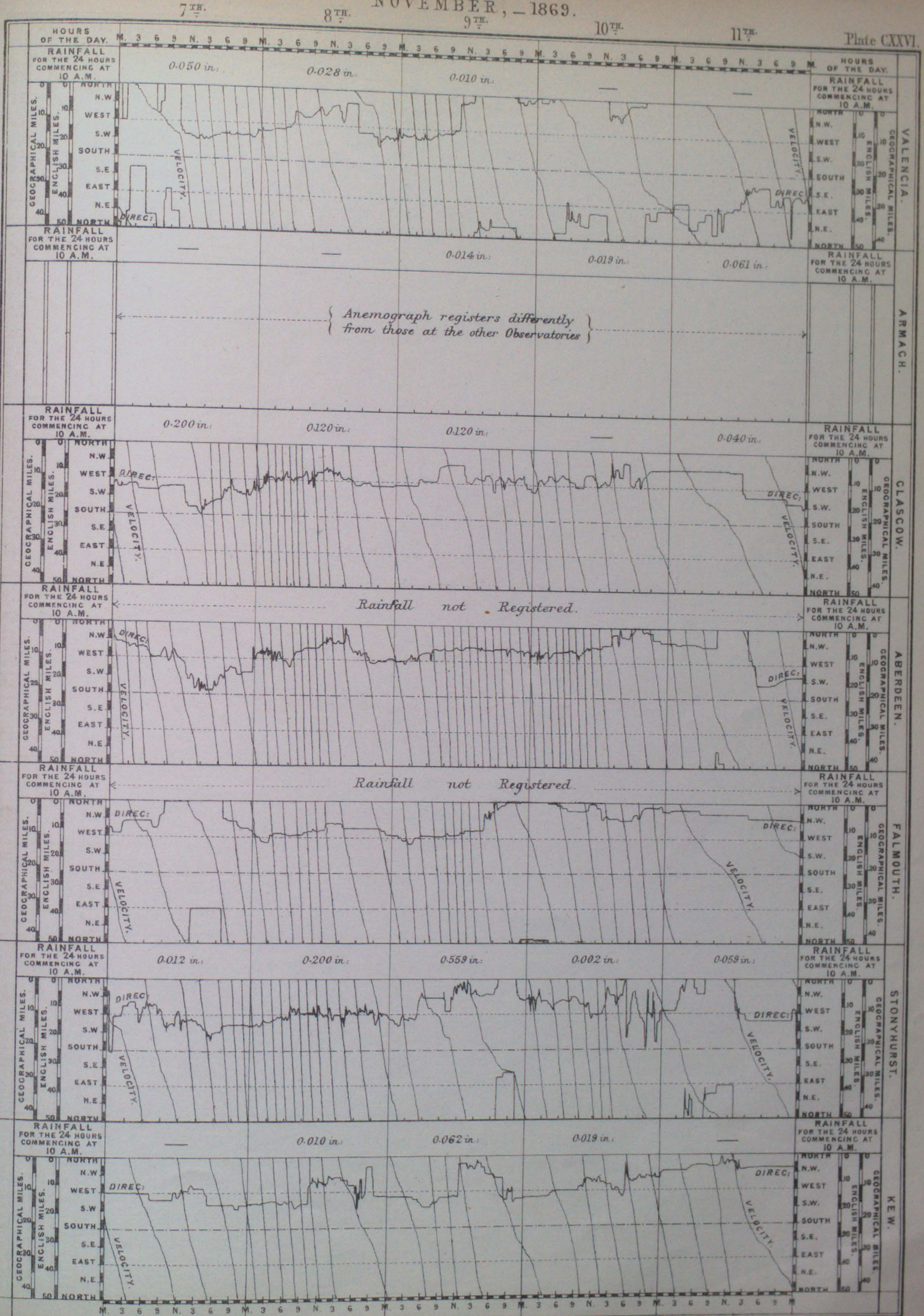
NOVEMBER, 1869.



Malby & Sons, Lith.

NOVEMBER, — 1869.

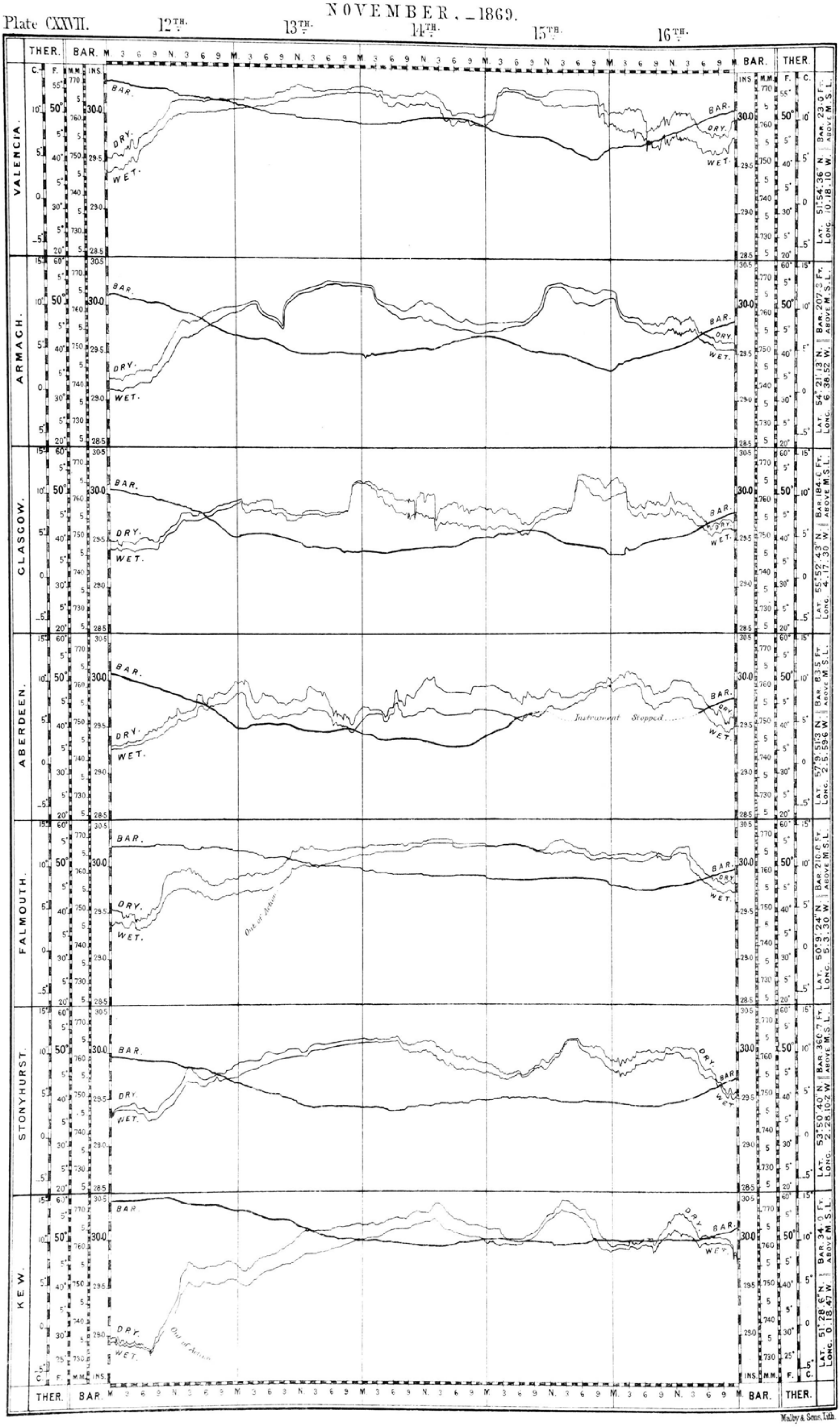
Plate CXXVI.



Malby & Sons, Lith.

Plate CXXVII.

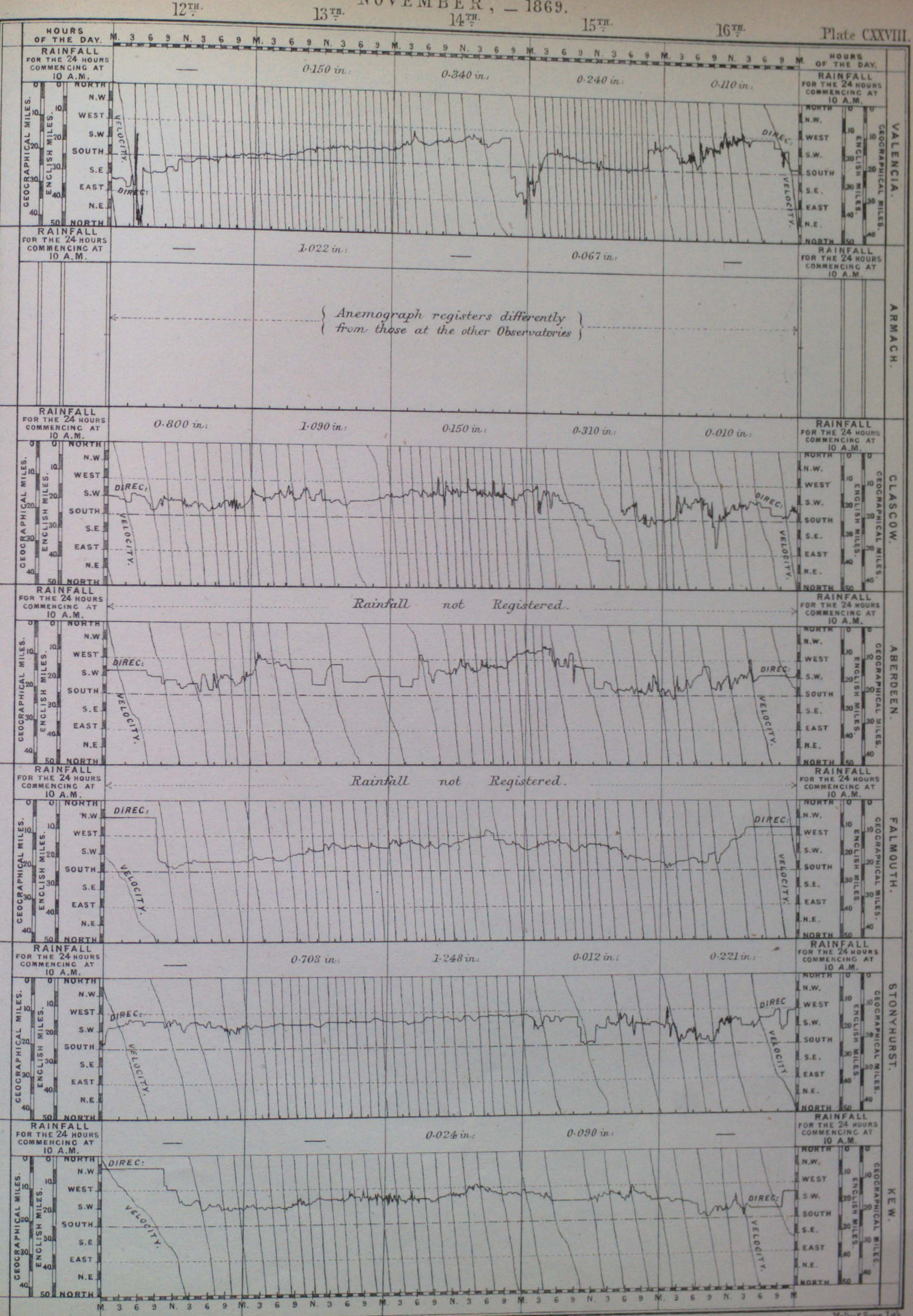
NOVEMBER, _1869.



Malby & Sons, Lith.

NOVEMBER, — 1869.

Plate CXXVIII.

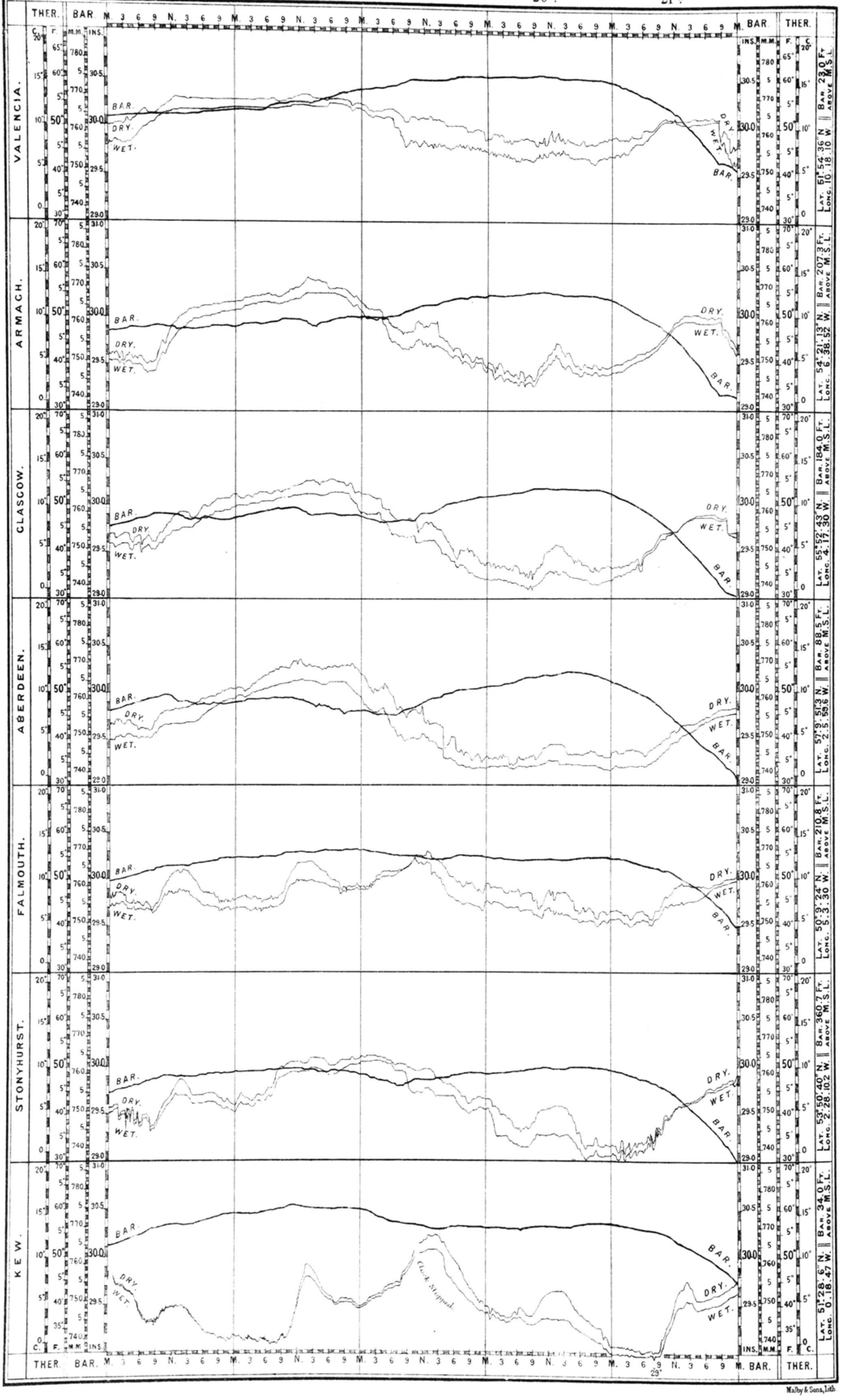


Malby & Sons, Lith.

Plate CXXIX.

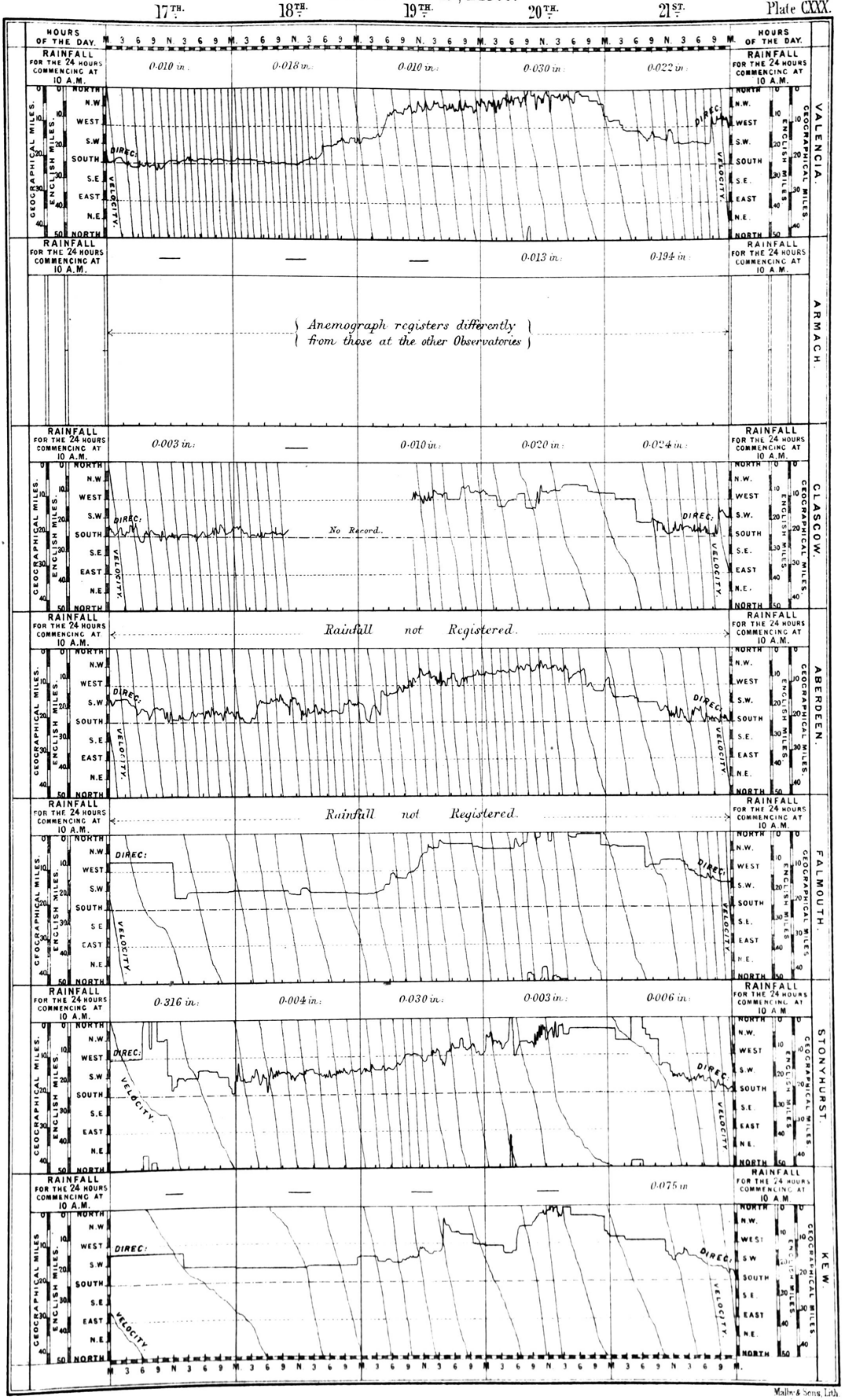
NOVEMBER, _1869.

17TH. 18TH. 19TH. 20TH. 21ST.



Malby & Sons, Lith.

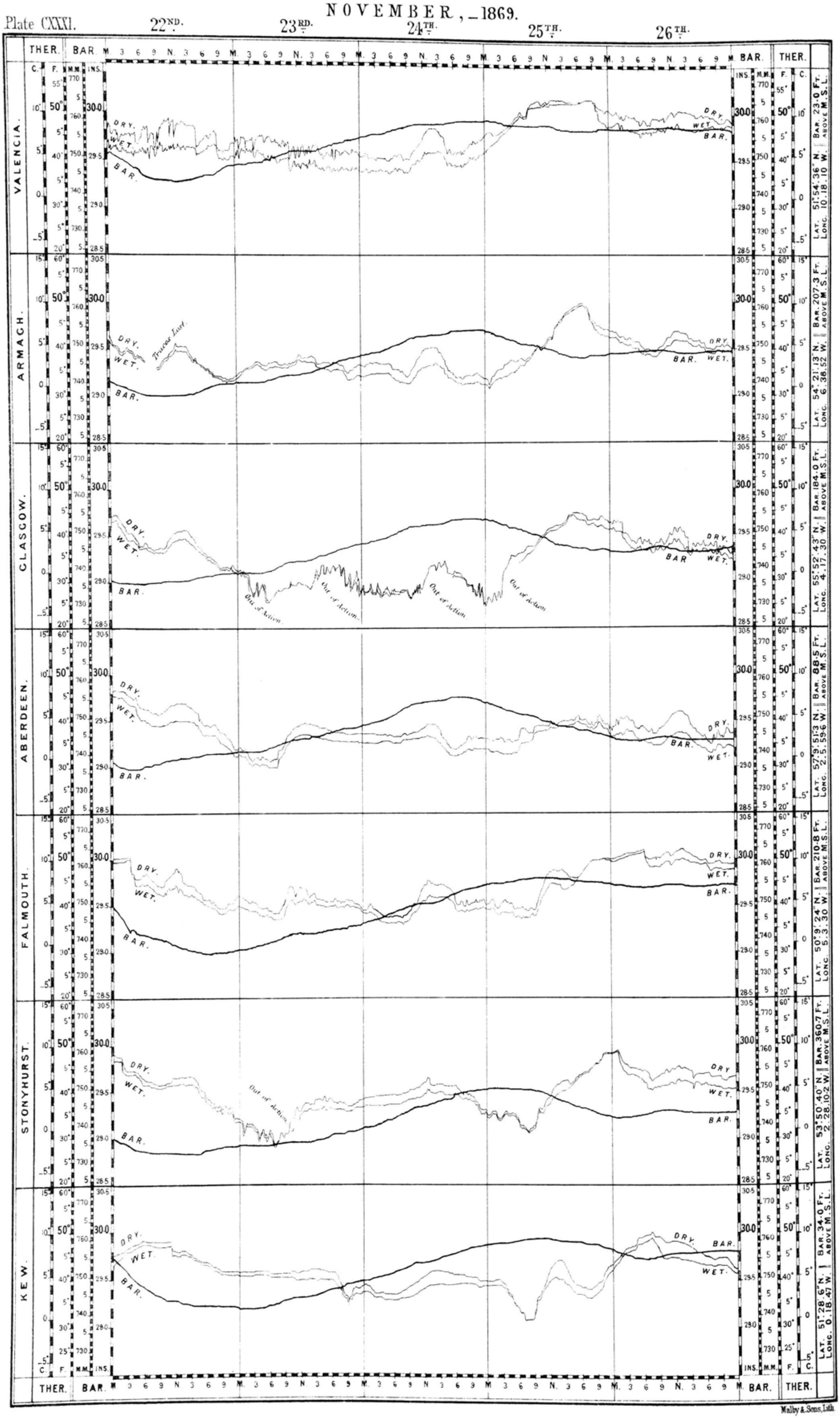
NOVEMBER, _1869.



Malby & Sons, Lith.

Plate CXXXI.

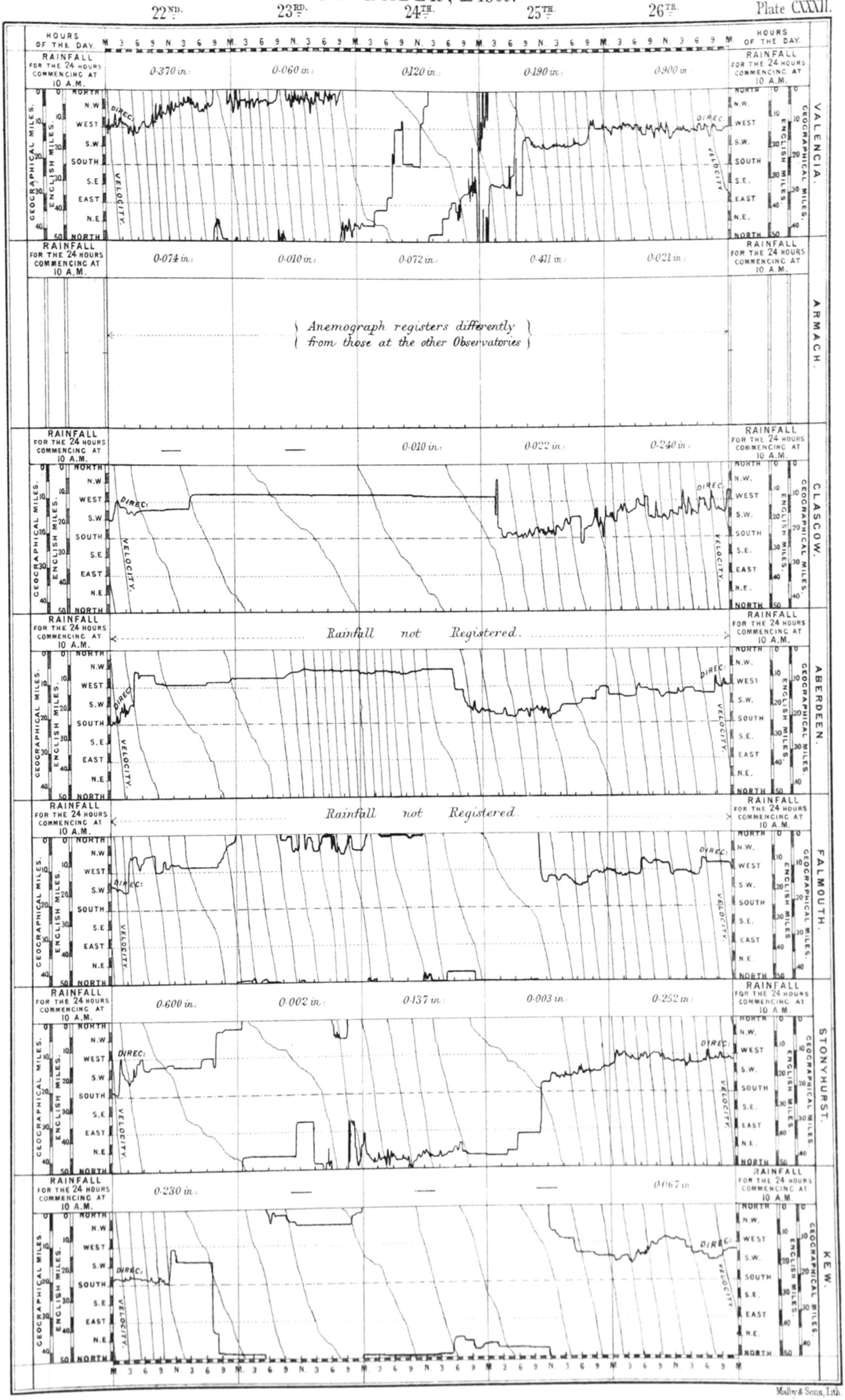
NOVEMBER, — 1869.



Malby & Sons, Lith.

NOVEMBER, — 1869.

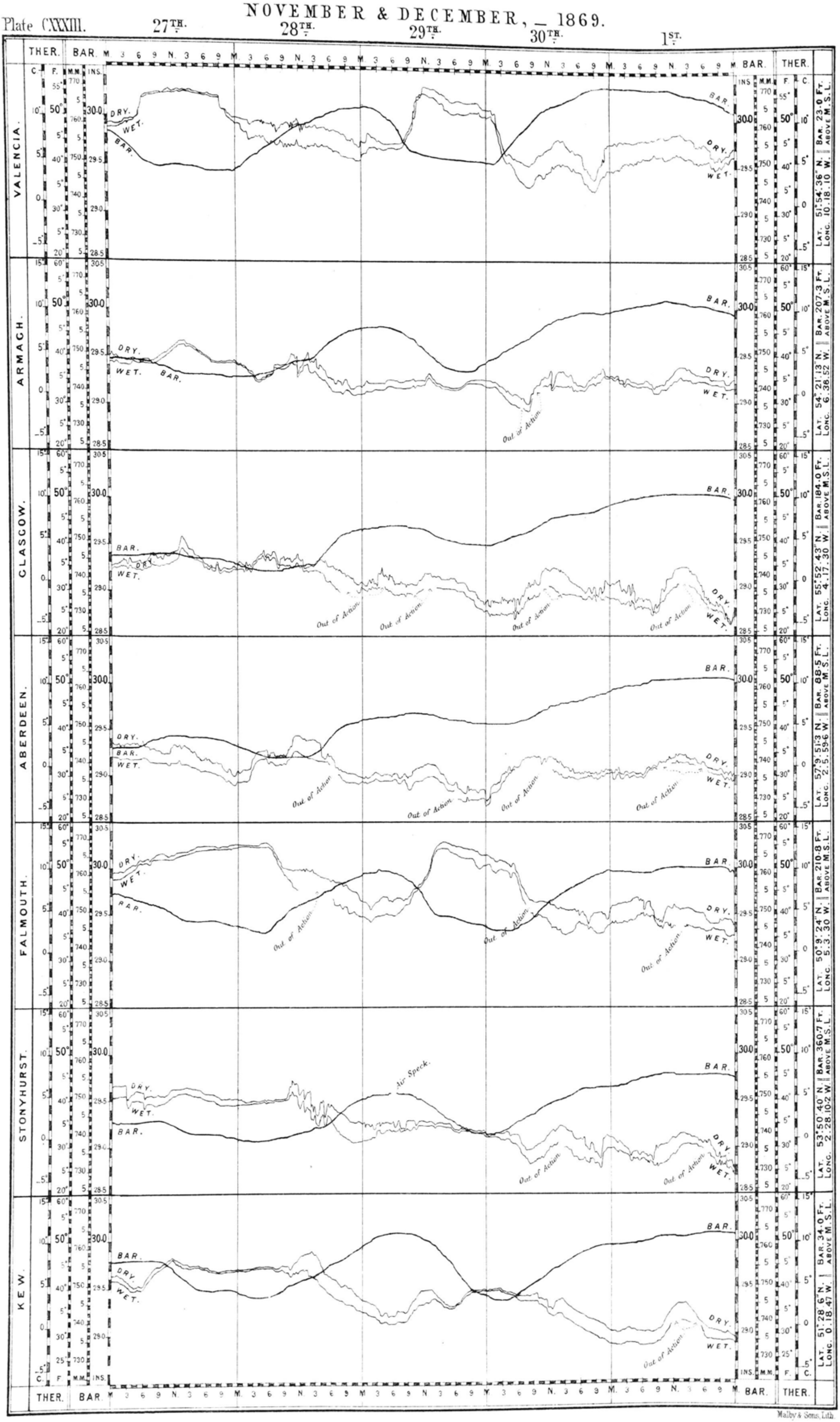
Plate CXXXII.



Malby & Sons, Lith.

Plate CXXXIII.

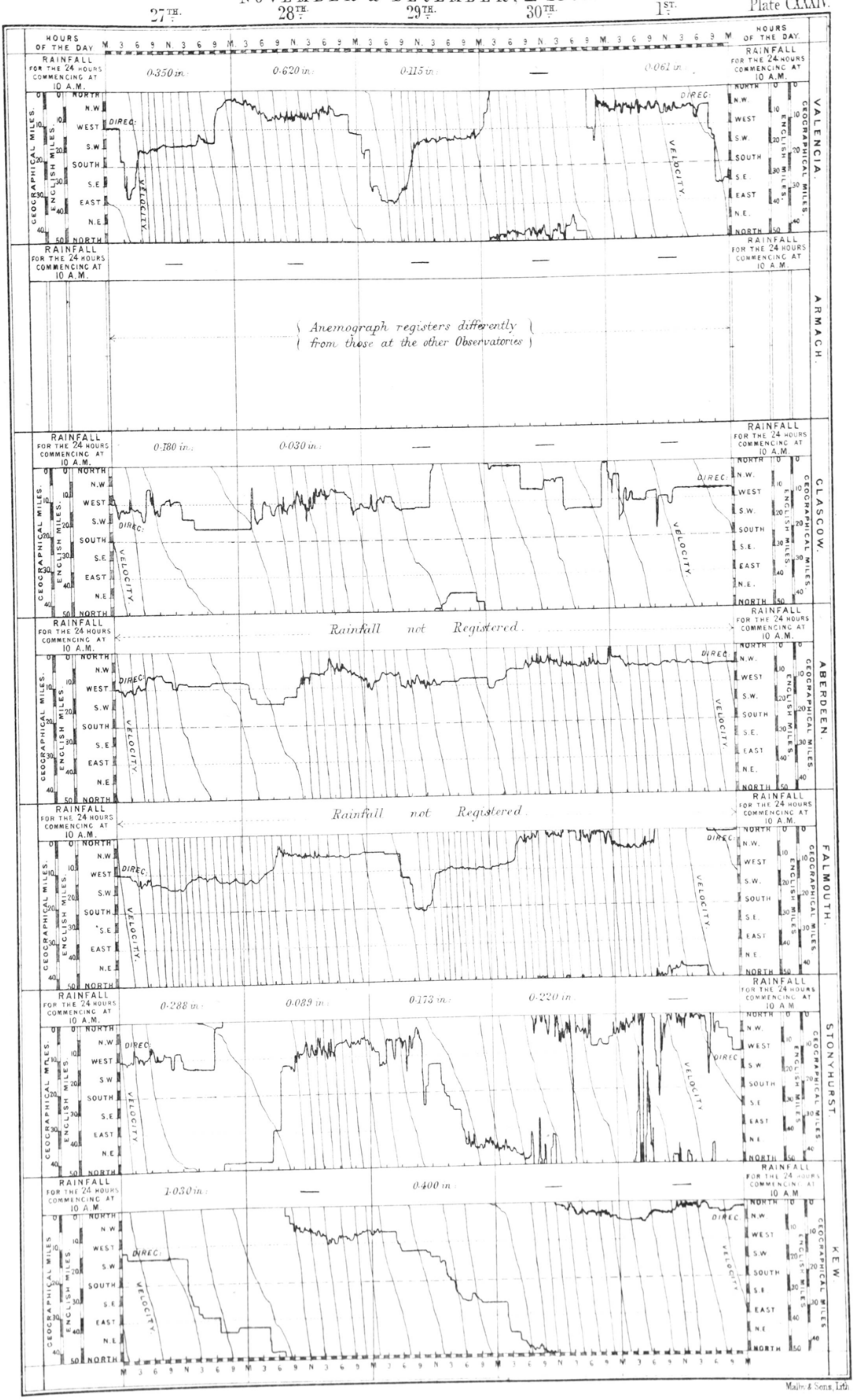
NOVEMBER & DECEMBER, _ 1869.



Malby & Sons, Lith.

NOVEMBER & DECEMBER, _ 1869.

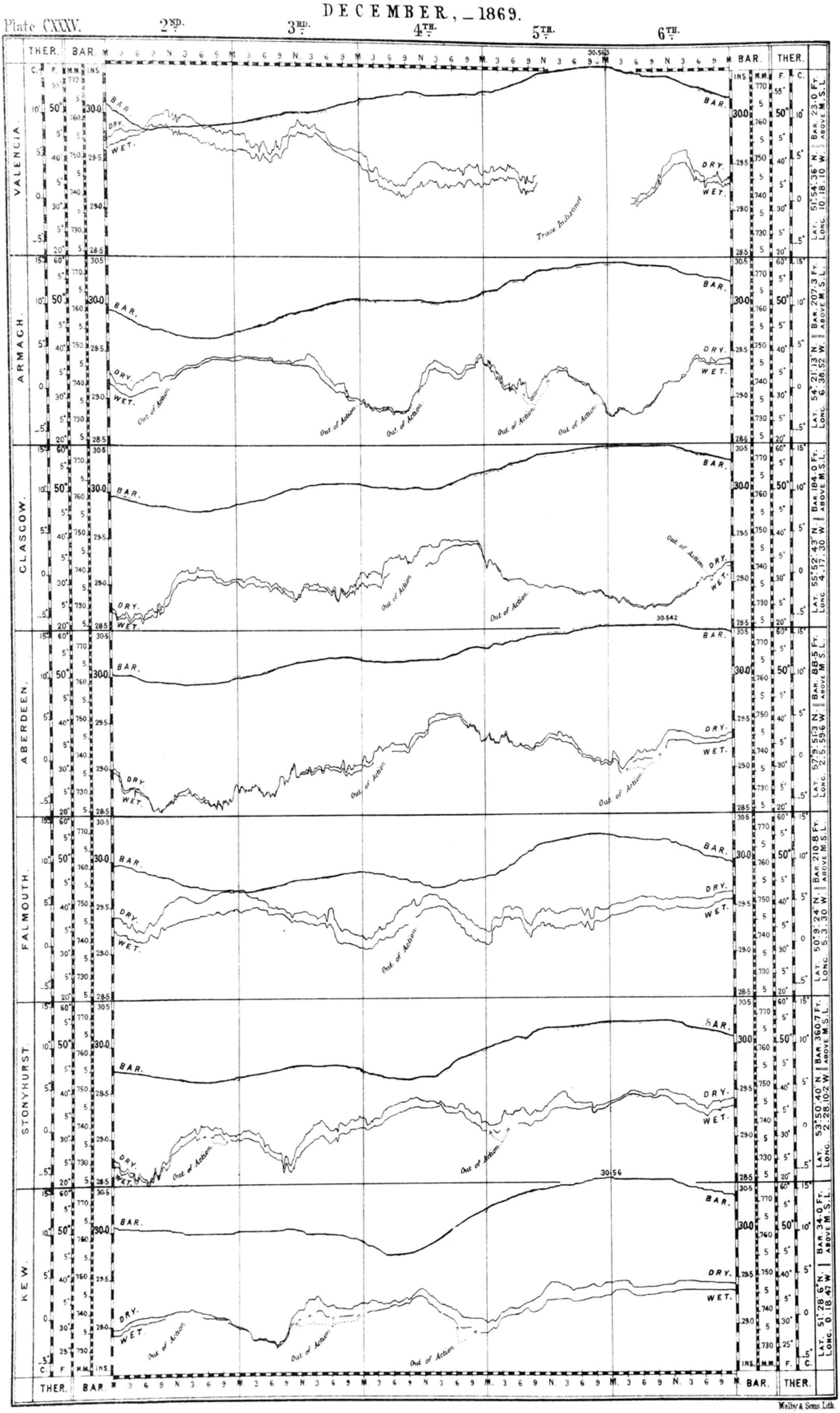
Plate CXXXIV.



Malby & Sons, Lith.

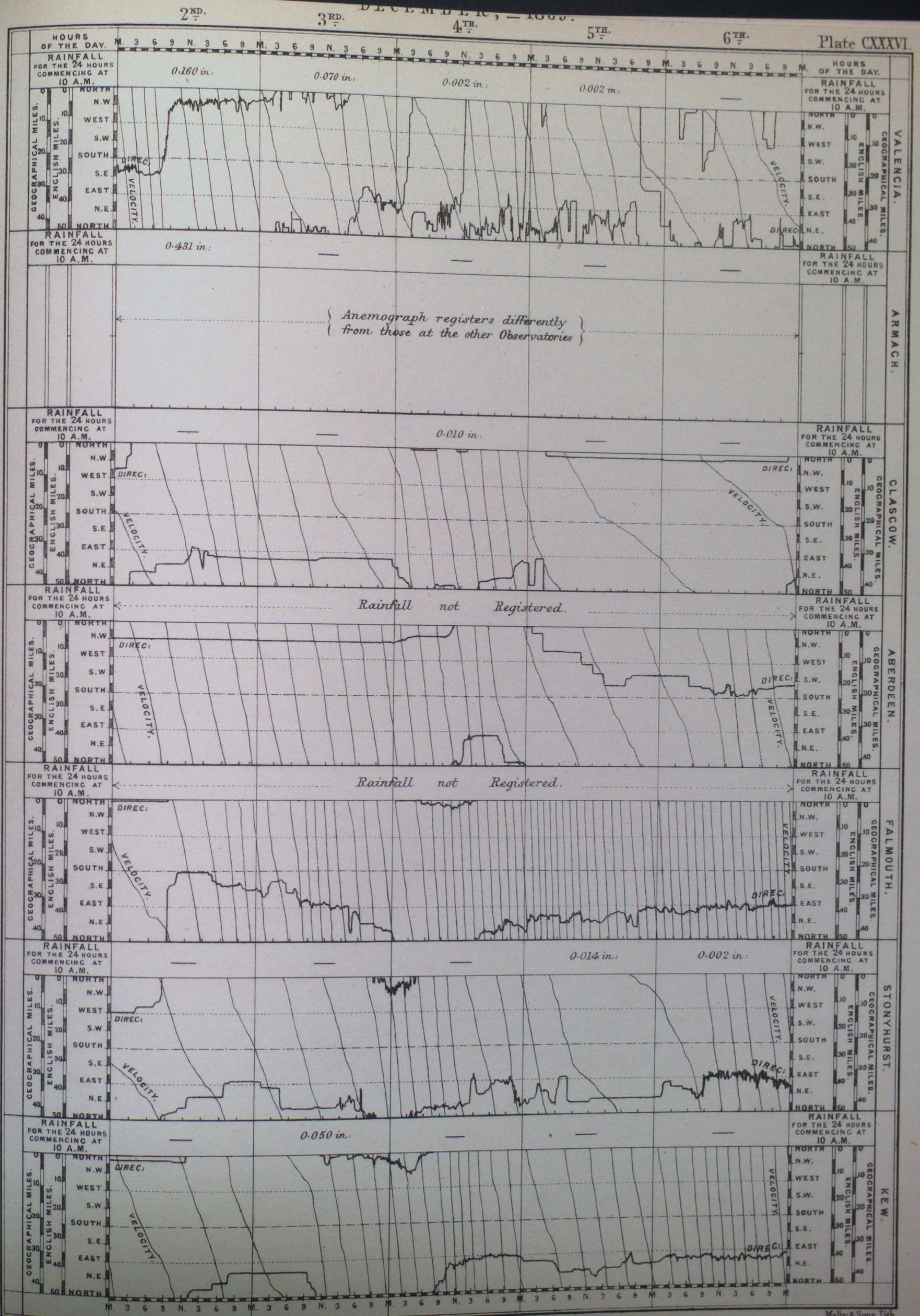
Plate CXXXV.

DECEMBER, _ 1869.



Melby & Sons Lith.

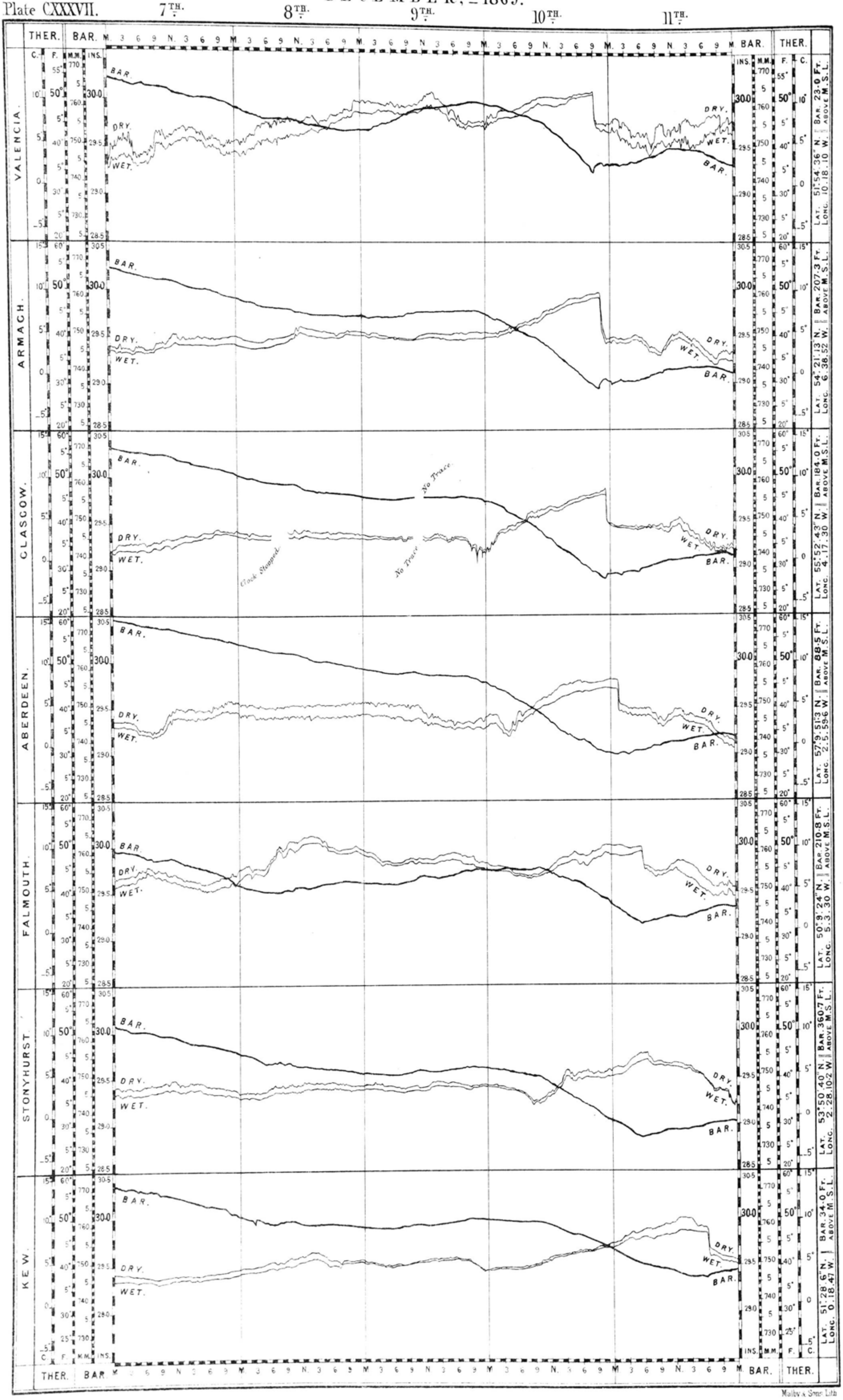
Plate CXXXVI.



Malby & Sons, Lith.

Plate CXXXVII.

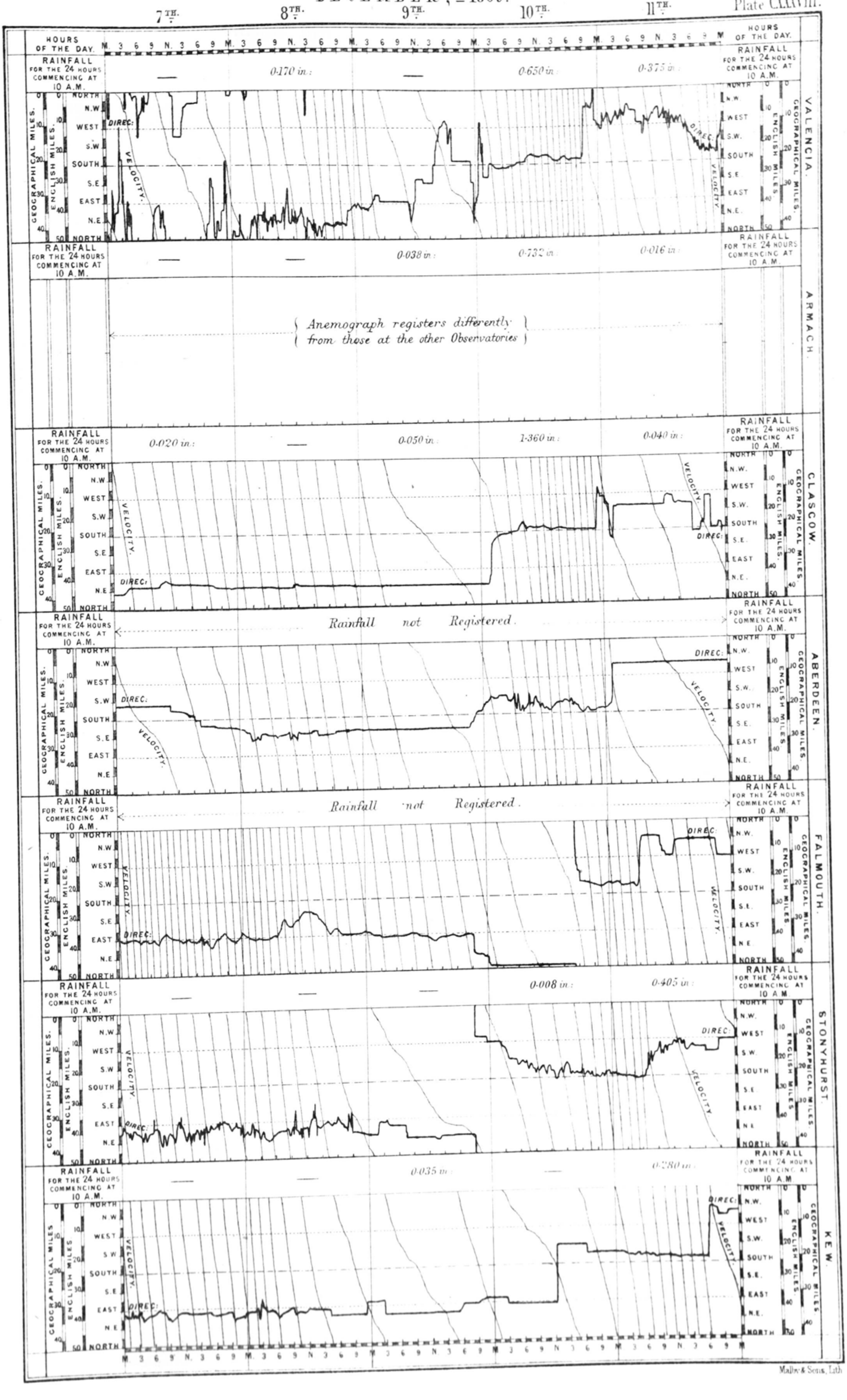
DECEMBER, _1869.



Malby & Sons Lith

DECEMBER, — 1869.

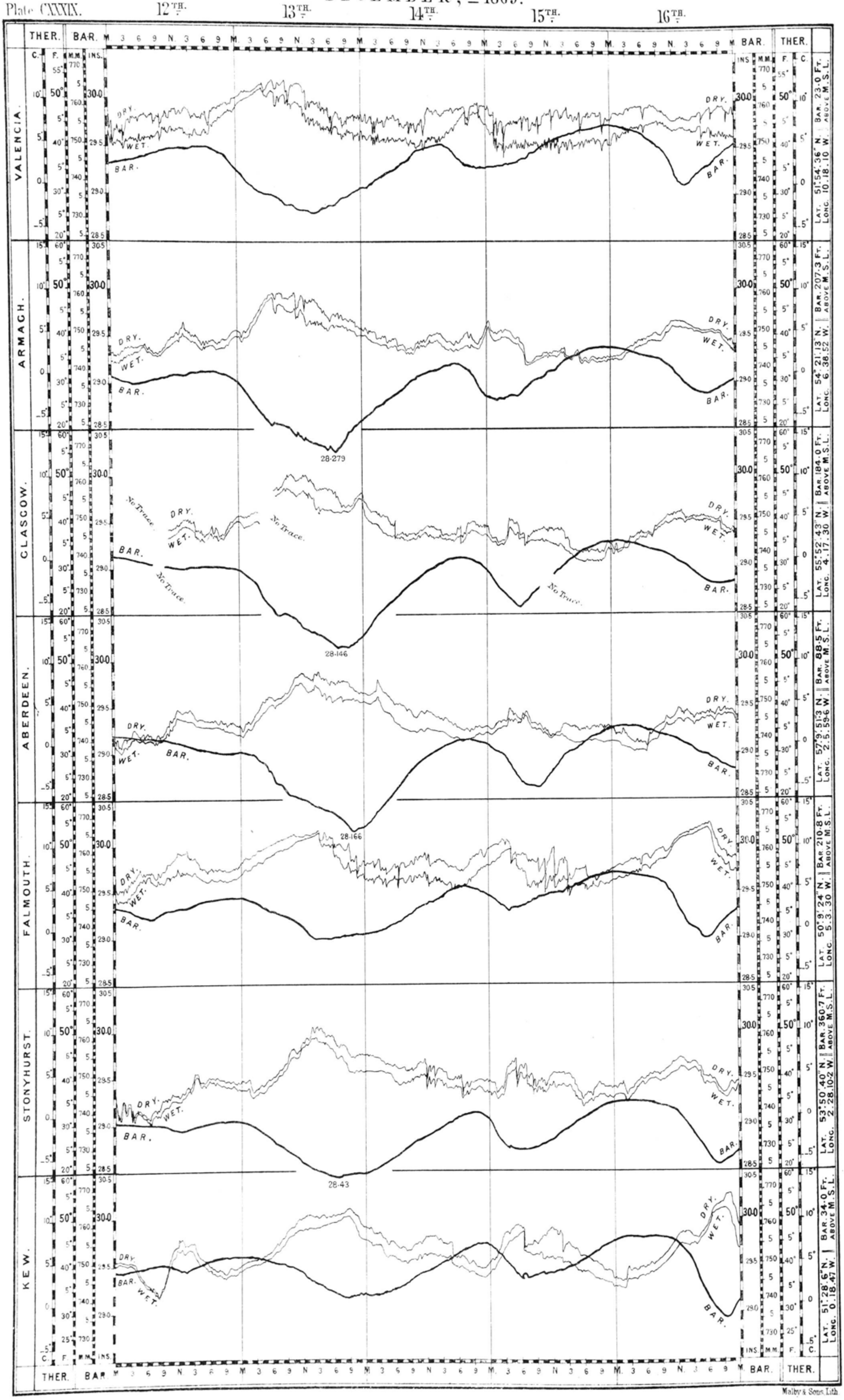
Plate CXXXVIII.



Malby & Sons, Lith.

Plate CXXXIX.

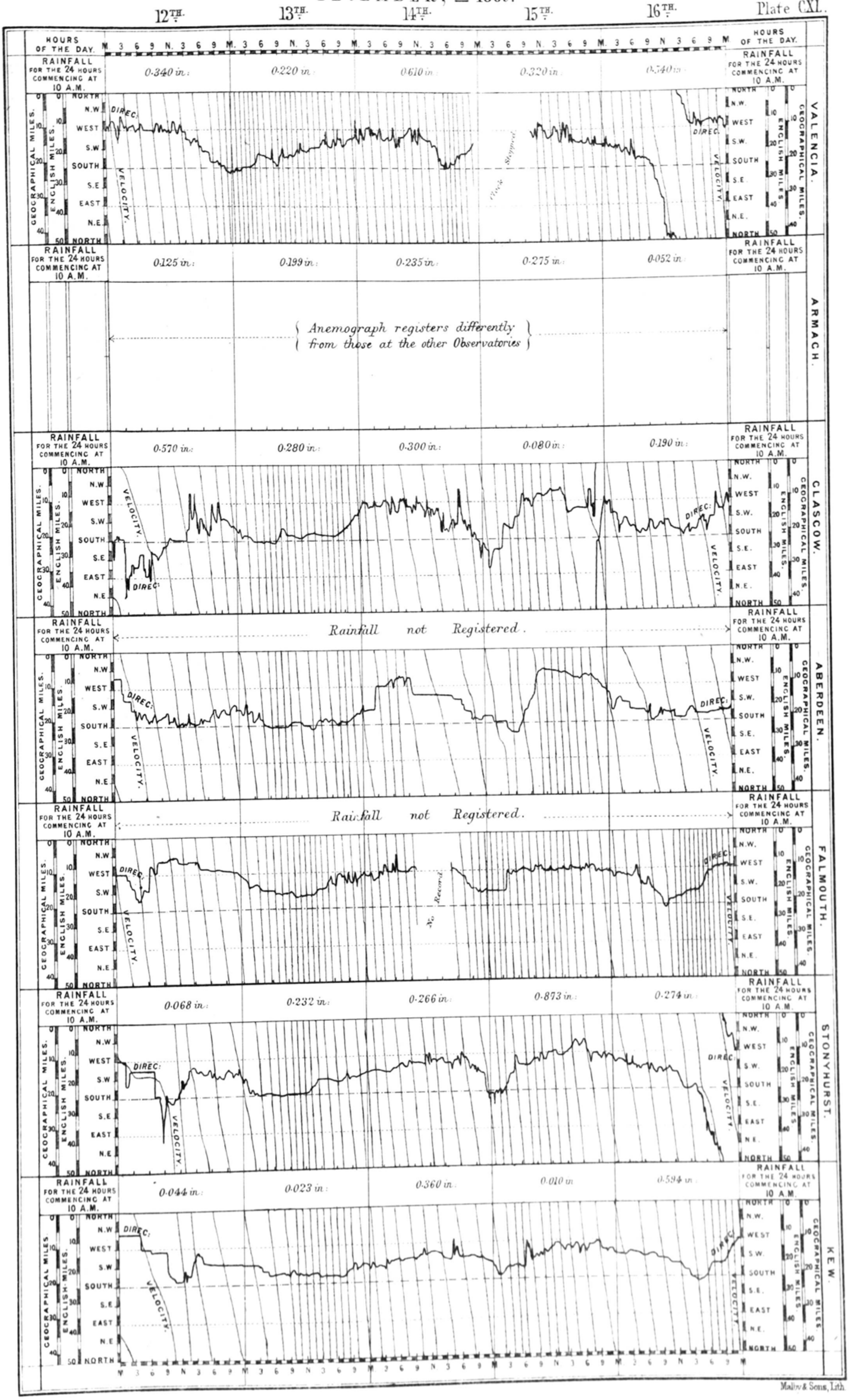
DECEMBER, — 1869.



Malby & Sons, Lith.

DECEMBER, — 1869.

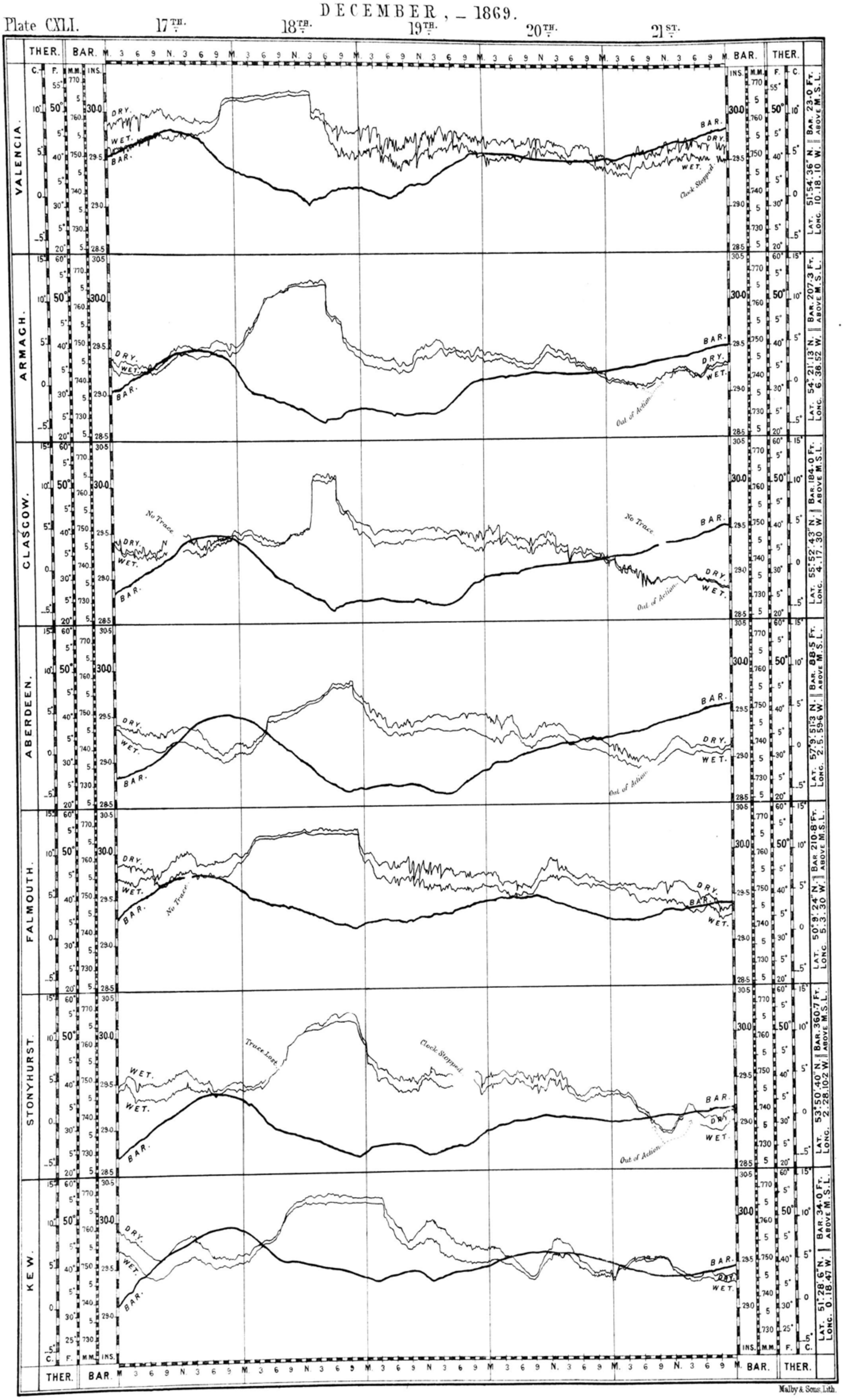
Plate CXL.



Malby & Sons, Lith.

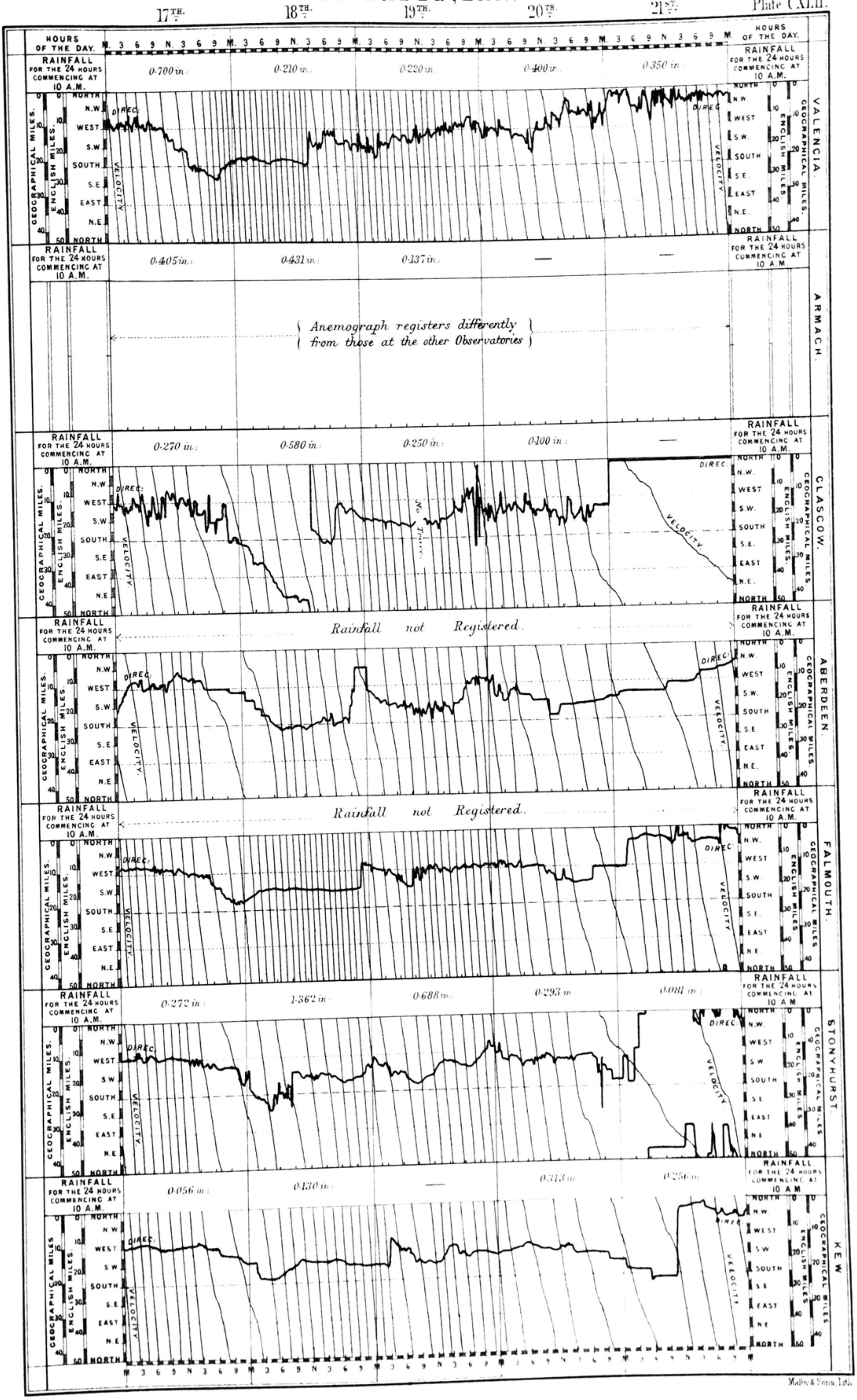
Plate CXLI.

DECEMBER, — 1869.



Malby & Sons, Lith.

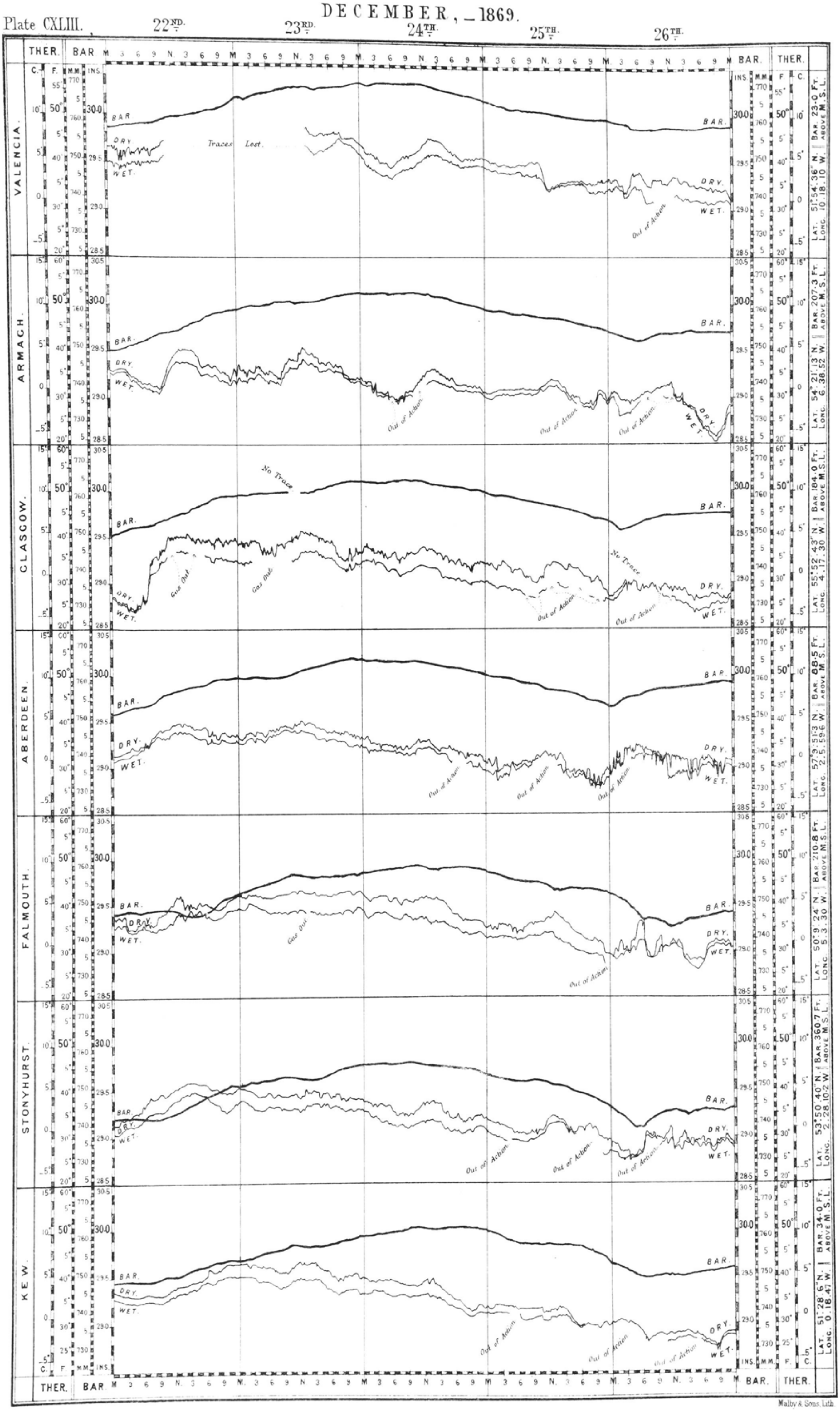
DECEMBER, _ 1869.



Maltby & Sons, Lith.

Plate CXLIII.

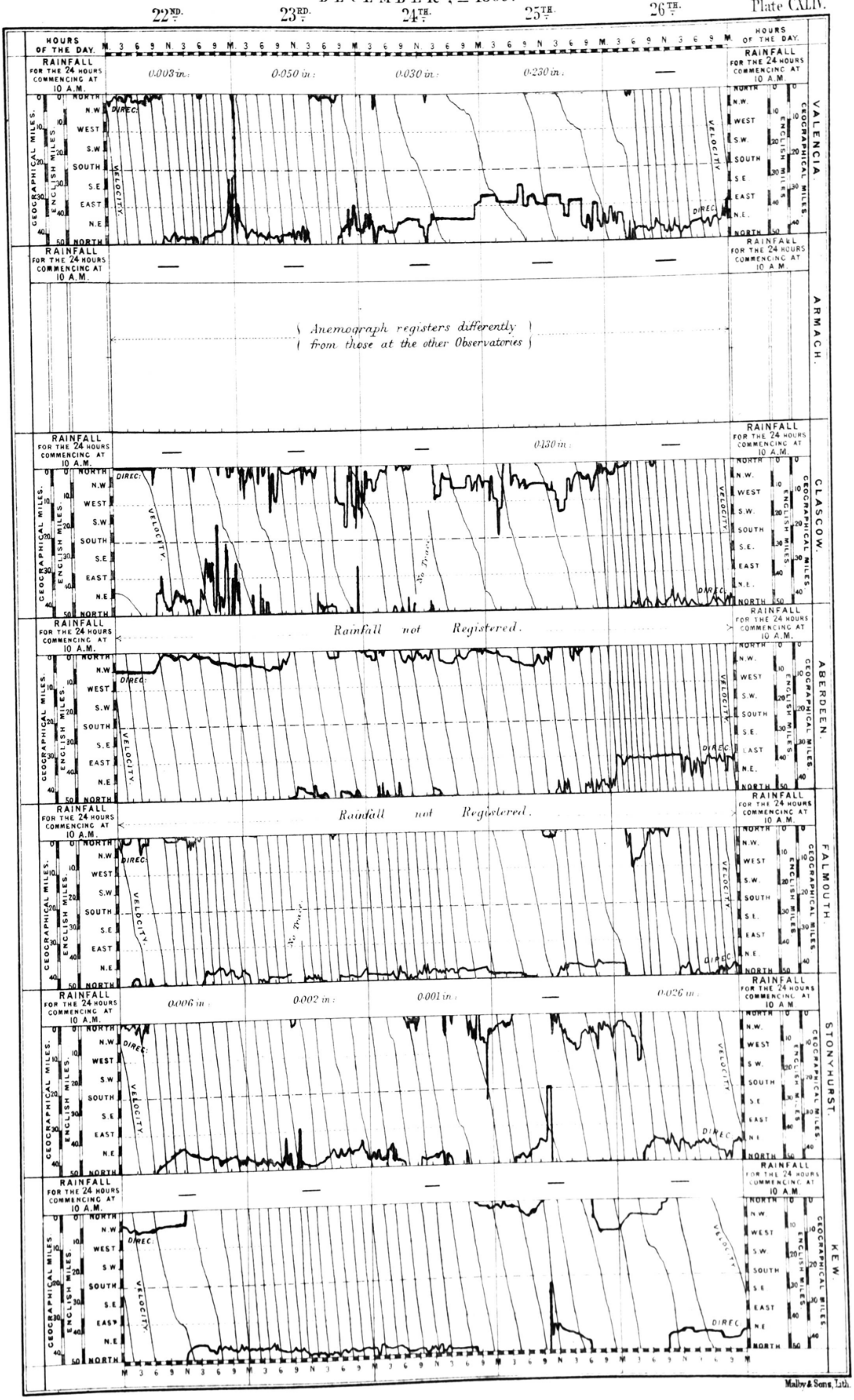
DECEMBER, — 1869.



Malby & Sons, Lith.

DECEMBER, _ 1869.

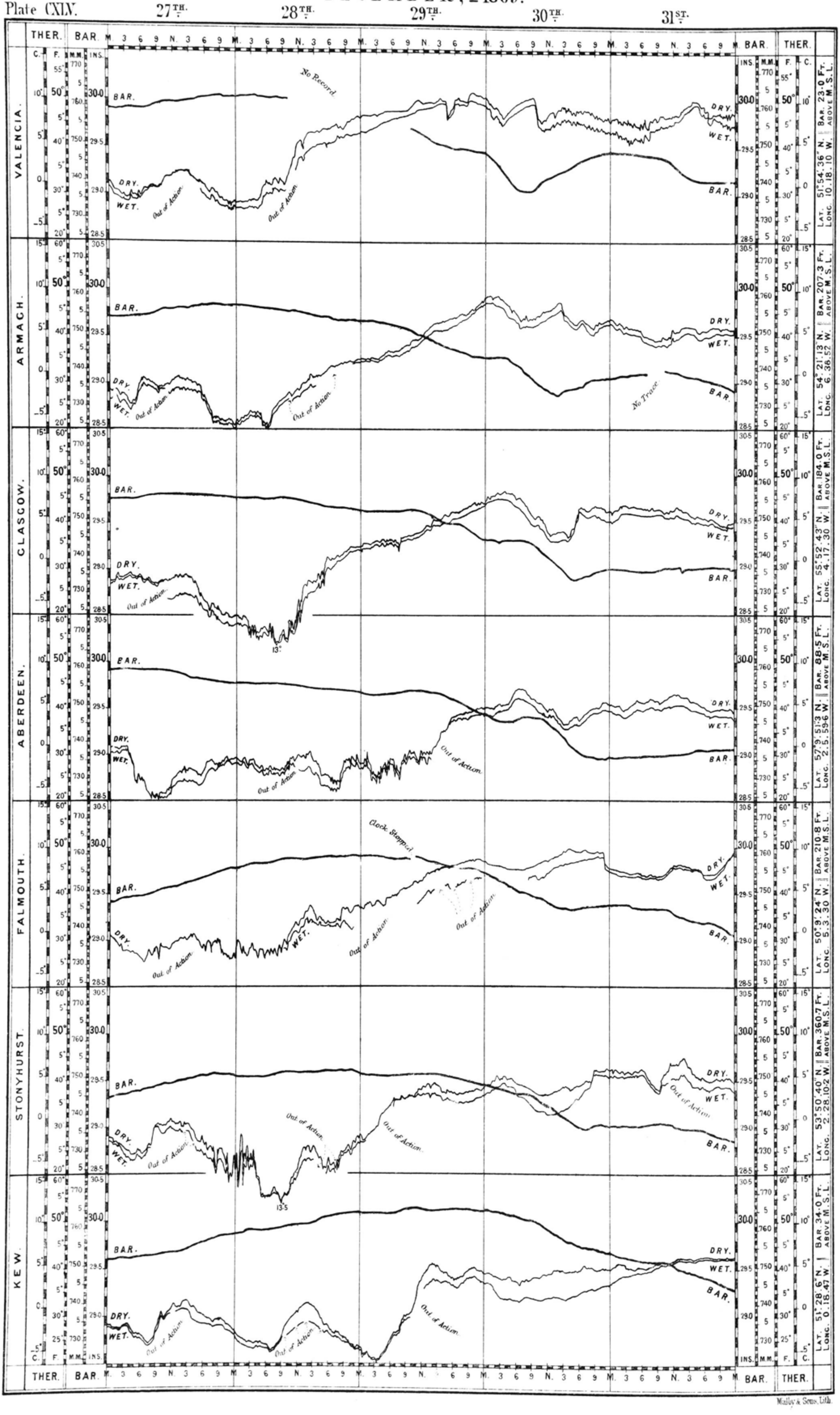
Plate CXLIV.



Malby & Sons, Lith.

DECEMBER, – 1869.

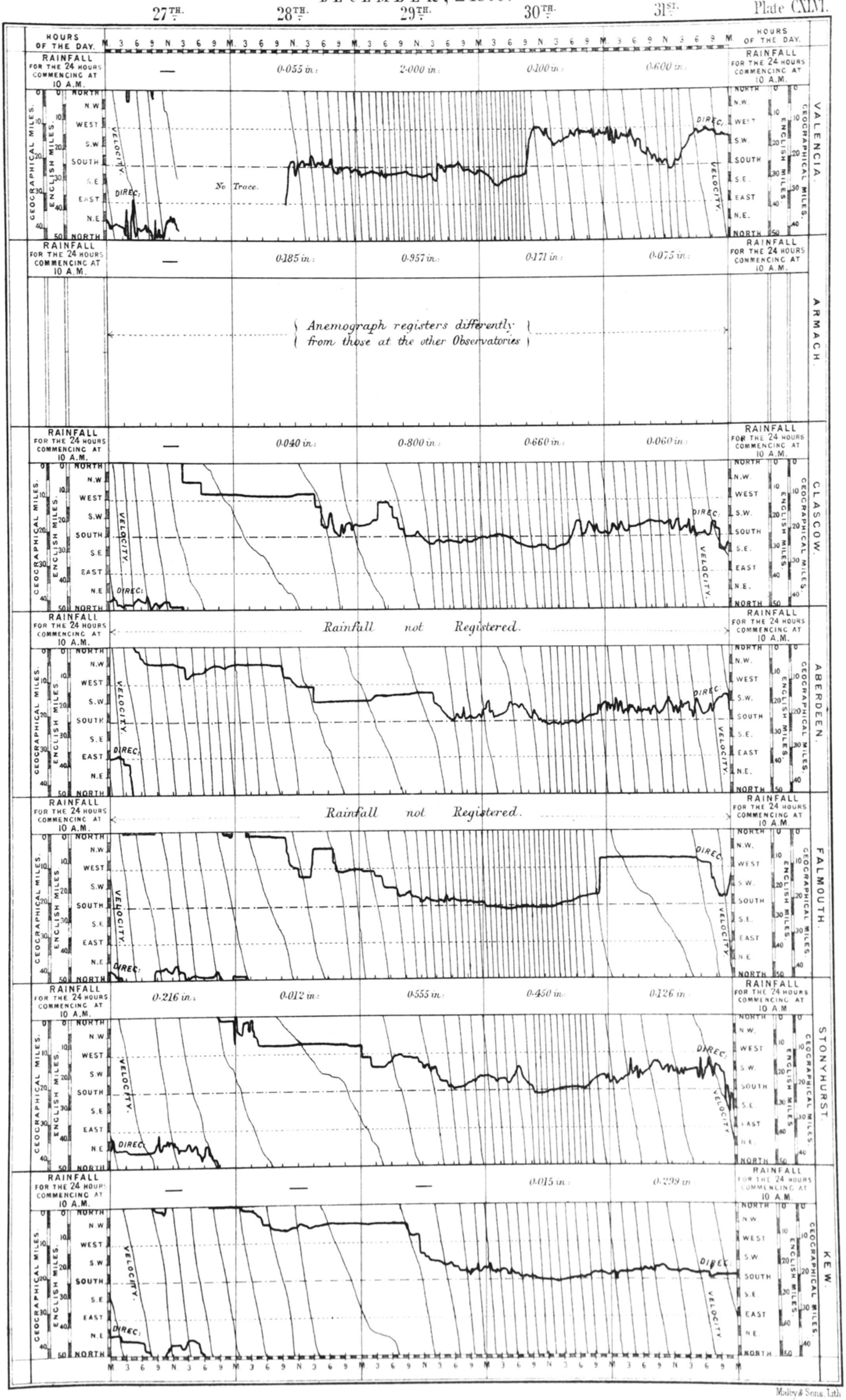
Plate CXLV.



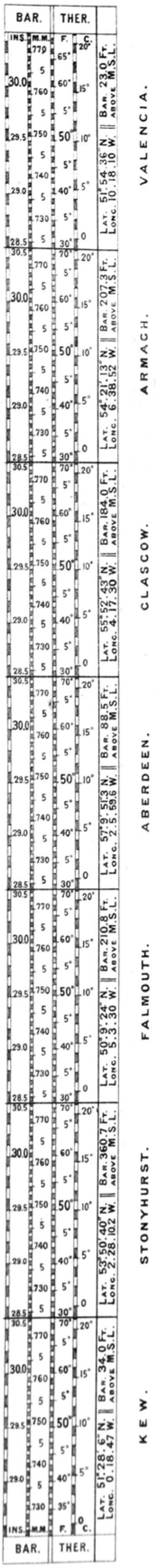
Mailly & Sons, Lith.

DECEMBER, _1869.

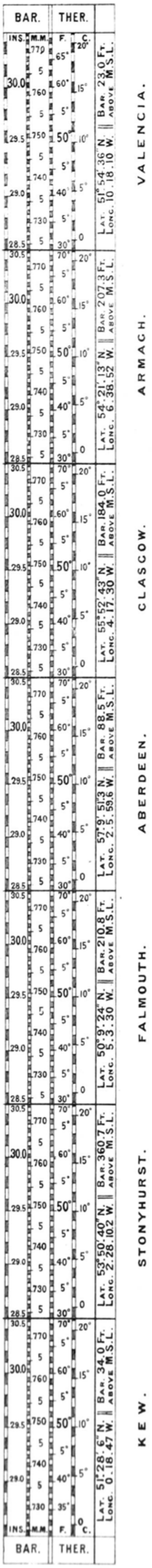
Plate CXLVI.



Malby & Sons, Lith.



BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
Lat. 51°54'36" N. Long. 10.18.10 W.
Bar. 23.0 Ft. above M.S.L.
ARMAGH.
Lat. 54°21'13" N. Long. 6.38.52 W.
Bar. 207.3 Ft. above M.S.L.
GLASGOW.
Lat. 55°52'43" N. Long. 4.17.30 W.
Bar. 184.0 Ft. above M.S.L.
ABERDEEN.
Lat. 57°9'51.3 N. Long. 2.5.59.6 W.
Bar. 88.5 Ft. above M.S.L.
FALMOUTH.
Lat. 50°9'24" N. Long. 5.3.30 W.
Bar. 210.8 Ft. above M.S.L.
STONYHURST.
Lat. 53°50'40" N. Long. 2.28.10.2 W.
Bar. 360.7 Ft. above M.S.L.
KEW.
Lat. 51°28'6" N. Long. 0.18.47 W.
Bar. 34.0 Ft. above M.S.L.



BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
Lat. 51°54'36" N. Long. 10.18.10 W.
Bar. 23.0 Ft. above M.S.L.
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Lat. 55°52'43" N. Long. 4.17.30 W.
Bar. 184.0 Ft. above M.S.L.
ABERDEEN.
Lat. 57°9'51.3 N. Long. 2.5.59.6 W.
Bar. 88.5 Ft. above M.S.L.
FALMOUTH.
Lat. 50°9'24" N. Long. 5.3.30 W.
Bar. 210.8 Ft. above M.S.L.
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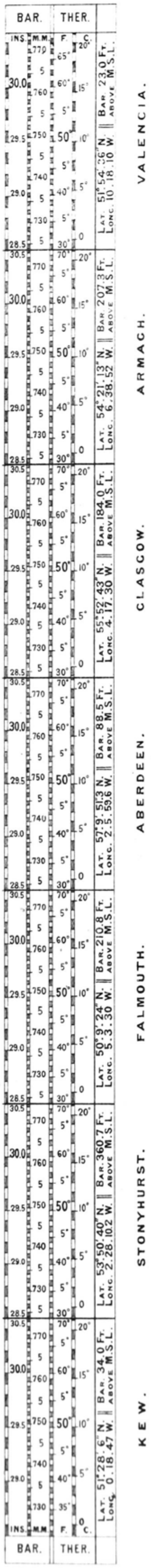
Lat. 53°50'40" N. Long. 2.28.10.2 W.
Bar. 360.7 Ft. above M.S.L.
KEW.
Lat. 51°28'6" N. Long. 0.18.47 W.
Bar. 34.0 Ft. above M.S.L.



BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
Lat. 51°54'36" N. Long. 10.18.10 W.
Bar. 23.0 Ft. above M.S.L.
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Lat. 54°21'13" N. Long. 6.38.52 W.
Bar. 207.3 Ft. above M.S.L.
GLASGOW.
Lat. 55°52'43" N. Long. 4.17.30 W.
Bar. 184.0 Ft. above M.S.L.
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Lat. 57°9'51.3 N. Long. 2.5.59.6 W.
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FALMOUTH.
Lat. 50°9'24" N. Long. 5.3.30 W.
Bar. 210.8 Ft. above M.S.L.
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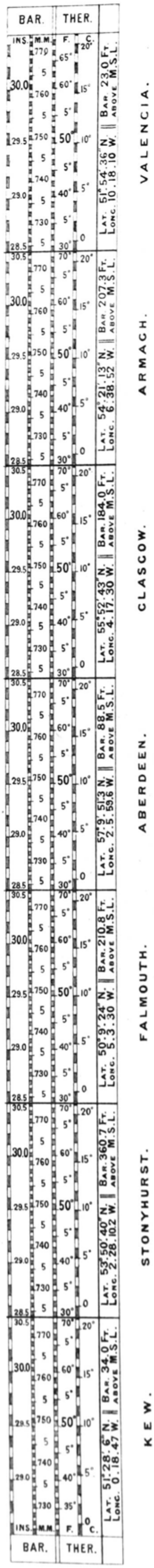
Lat. 53°50'40" N. Long. 2.28.10.2 W.
Bar. 360.7 Ft. above M.S.L.
KEW.
Lat. 51°28'6" N. Long. 0.18.47 W.
Bar. 34.0 Ft. above M.S.L.



BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
Lat. 51°54'36" N. Long. 10.18.10 W.
Bar. 23.0 Ft. above M.S.L.
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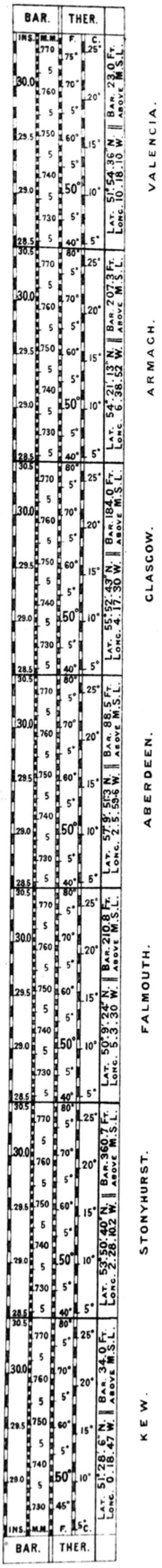
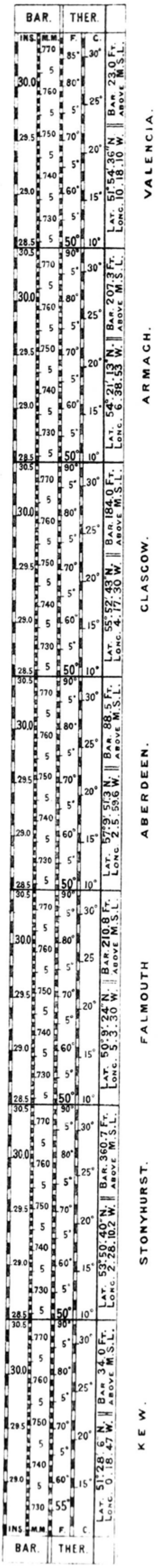
Lat. 54°21'13" N. Long. 6.38.52 W.
Bar. 207.3 Ft. above M.S.L.
GLASGOW.
Lat. 55°52'43" N. Long. 4.17.30 W.
Bar. 184.0 Ft. above M.S.L.
ABERDEEN.
Lat. 57°9'51.3 N. Long. 2.5.59.6 W.
Bar. 88.5 Ft. above M.S.L.
FALMOUTH.
Lat. 50°9'24" N. Long. 5.3.30 W.
Bar. 210.8 Ft. above M.S.L.
STONYHURST.
Lat. 53°50'40" N. Long. 2.28.10.2 W.
Bar. 360.7 Ft. above M.S.L.
KEW.
Lat. 51°28'6" N. Long. 0.18.47 W.
Bar. 34.0 Ft. above M.S.L.

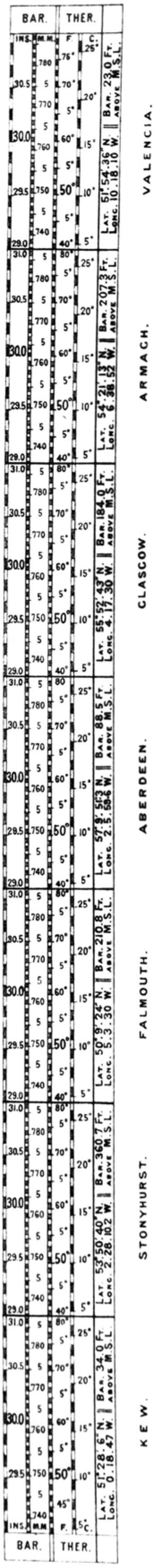
These Scales may be Cut out and used in Measuring the Curves.


BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
LAT. 51°54'36" N. LONG. 10.18.10 W. ‖ BAR. 23.0 FT. ABOVE M.S.L.
ARMAGH.
LAT. 54°21'13" N. LONG. 6.38.52 W. ‖ BAR. 207.3 FT. ABOVE M.S.L.
GLASGOW.
LAT. 55°52'43" N. LONG. 4.17.30 W. ‖ BAR. 184.0 FT. ABOVE M.S.L.
ABERDEEN.
LAT. 57°9'51.3 N. LONG. 2.5.59.6 W. ‖ BAR. 88.5 FT. ABOVE M.S.L.
FALMOUTH.
LAT. 50°9'24" N. LONG. 5.3.30 W. ‖ BAR. 210.8 FT. ABOVE M.S.L.
STONYHURST.
LAT. 53°50'40" N. LONG. 2.28.10.2 W. ‖ BAR. 360.7 FT. ABOVE M.S.L.
KEW.
LAT. 51°28'6" N. LONG. 0.18.47 W. ‖ BAR. 34.0 FT. ABOVE M.S.L.

For all Plates, excepting XCV & XCVII.

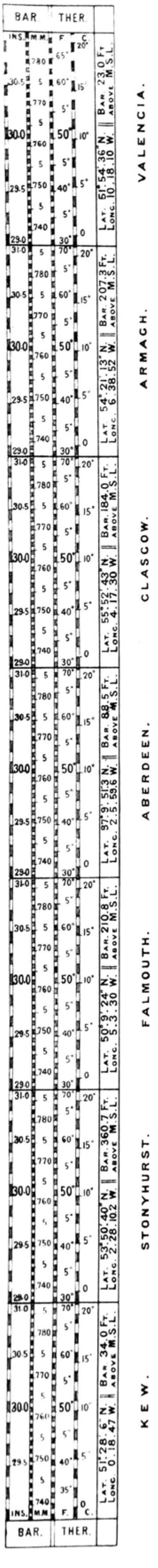

BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
LAT. 51°54'36" N. LONG. 10.18.10 W. ‖ BAR. 23.0 FT. ABOVE M.S.L.
ARMAGH.
LAT. 54°21'13" N. LONG. 6.38.53 W. ‖ BAR. 207.3 FT. ABOVE M.S.L.
GLASGOW.
LAT. 55°52'43" N. LONG. 4.17.30 W. ‖ BAR. 184.0 FT. ABOVE M.S.L.
ABERDEEN.
LAT. 57°9'51.3 N. LONG. 2.5.59.6 W. ‖ BAR. 88.5 FT. ABOVE M.S.L.
FALMOUTH
LAT. 50°9'24" N. LONG. 5.3.30 W. ‖ BAR. 210.8 FT. ABOVE M.S.L.
STONYHURST.
LAT. 53°50'40" N. LONG. 2.28.10.2 W. ‖ BAR. 360.7 FT. ABOVE M.S.L.
KEW.
LAT. 51°28'6" N. LONG. 0.18.47 W. ‖ BAR. 34.0 FT. ABOVE M.S.L.

For Plate XCV.


BAR.
THER.
INS.
M.M.
F.
C.
VALENCIA.
LAT. 51°54'36" N. LONG. 10.18.10 W. ‖ BAR. 23.0 FT. ABOVE M.S.L.
ARMAGH.
LAT. 54°21'13" N. LONG. 6.38.52 W. ‖ BAR. 207.3 FT. ABOVE M.S.L.
GLASGOW.
LAT. 55°52'43" N. LONG. 4.17.30 W. ‖ BAR. 184.0 FT. ABOVE M.S.L.
ABERDEEN.
LAT. 57°9'51.3 N. LONG. 2.5.59.6 W. ‖ BAR. 88.5 FT. ABOVE M.S.L.
FALMOUTH.
LAT. 50°9'24" N. LONG. 5.3.30 W. ‖ BAR. 210.8 FT. ABOVE M.S.L.
STONYHURST.
LAT. 53°50'40" N. LONG. 2.28.10.2 W. ‖ BAR. 360.7 FT. ABOVE M.S.L.
KEW.
LAT. 51°28'6" N. LONG. 0.18.47 W. ‖ BAR. 34.0 FT. ABOVE M.S.L.

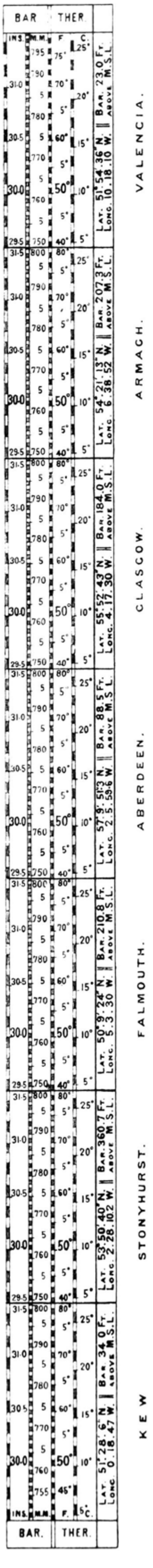
For Plate XCVII.

These Scales may be Cut out and used in Measuring the Curves.



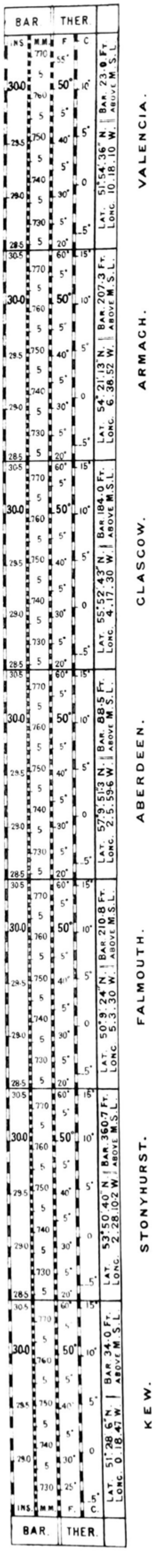
BAR. THER.
INS. M.M. F. C.
VALENCIA.
LAT. 51°54'36"N. LONG. 10.18.10 W.
BAR. 23.0 FT. ABOVE M.S.L.
ARMAGH.
LAT. 54°21'13"N. LONG. 6.38.52 W.
BAR. 207.3 FT. ABOVE M.S.L.
GLASCOW.
LAT. 55°52'43"N. LONG. 4.17.30 W.
BAR. 184.0 FT. ABOVE M.S.L.
ABERDEEN.
LAT. 57°9'51.3"N. LONG. 2.5.59.6 W.
BAR. 88.5 FT. ABOVE M.S.L.
FALMOUTH.
LAT. 50°9'24"N. LONG. 5.3.30 W.
BAR. 210.8 FT. ABOVE M.S.L.
STONYHURST.
LAT. 53°50'40"N. LONG. 2.28.10.2 W.
BAR. 360.7 FT. ABOVE M.S.L.
KEW.
LAT. 51°28'6"N. LONG. 0.18.47 W.
BAR. 34.0 FT. ABOVE M.S.L.

For Plates CIX, CXI, CXVII, CXIX, CXXI, CXXIII & CXXIX.



BAR. THER.
INS. M.M. F. C.
VALENCIA.
ARMAGH.
GLASCOW.
ABERDEEN.
FALMOUTH.
STONYHURST.
KEW.

For Plate CXIII.



BAR. THER.
INS. M.M. F. C.
VALENCIA.
ARMAGH.
GLASCOW.
ABERDEEN.
FALMOUTH.
STONYHURST.
KEW.

For Plates CXV, CXXV, CXXVII, CXXXI, CXXXIII, CXXXV, CXXXVII, CXXXIX, CXLI, CXLIII & CXLV.

These Scales may be Cut out and used in Measuring the Curves